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C. K. COLE, M. D.,

HELENA, MONT.

First President American Academy of Railway Surgeons; Chief Surgeon Montana Central Railway.

THE AMERICAN ACADEMY OF RAILWAY SURGEONS.

Report of the Second Annual Meeting

HELD AT

CHICAGO, ILL., SEPT. 25, 26 AND 27, 1895.

LANE LIBRARY

EDITED BY

R. HARVEY REED, M.D.

COLUMBUS, OHIO.

CHICAGO:
AMERICAN MEDICAL ASSOCIATION PRESS.
1896.

THE HIGHER THE ORDER OF RAILWAY SURGERY THE GREATER

THE PROTECTION TO THE EMPLOYE, THE PASSENGER

AND THE COMPANY.

VANDERBILT

PREFACE.

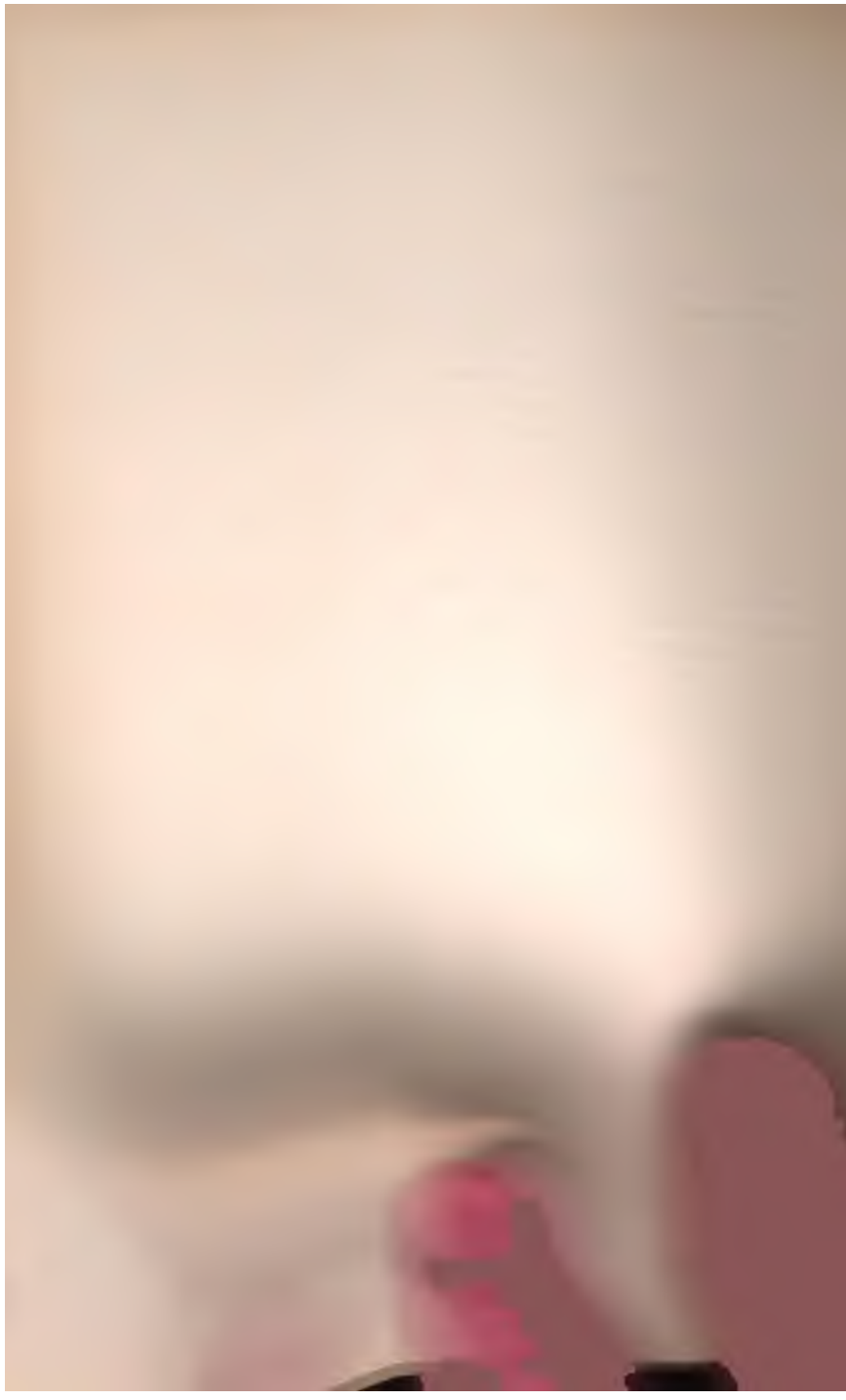
In presenting the report of the second annual meeting of the American Academy of Railway Surgeons it affords your Editor great pleasure to be enabled to give you a volume containing nearly 100 pages more than that of last year. He has classified the excellent scientific work into chapters, in order that the reader might the more easily turn to any particular subject, and in one chapter find all the papers and discussions thereon. In preparing the index he has arranged it so as to enable the reader to refer to the work of any particular Fellow and ascertain any subject he may have written upon, or to look up any particular subject and determine who wrote on it or took part in its discussion.

The interest manifested during the past year by the management of the railroads throughout this country has been of such a character as to warrant our Fellows in combining their best efforts with an eye single to the betterment of Railway Surgery. That the Fellows have responded to the trust imposed in them by the management of their various companies, is manifested by the care with which they have prepared the contents of this volume. Railway companies are learning by experience that a well organized surgical department is just as truly an essential to the company's prosperity as any other department that has for its object the protection of the company's interests. The increase in fellowship and the interest shown by the Fellows of this Academy both point to a higher excellence in railway surgery.

It is the ambition of your Editor that each succeeding volume of transactions of this Academy shall excel its predecessor and that by the pre-eminence of your work you shall make it worthy of your great trust.

R. HARVEY REED.

Columbus, Ohio, June 20, 1896.



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ROLL OF OFFICERS FOR 1895-96.

PRESIDENT—John E. Owens, M.D., Chief Surgeon C. & N. W. R'y, Chicago, Ill.

FIRST VICE-PRESIDENT—L. E. Lemen, M.D., Division Surgeon U. P. R'y, Denver, Colo.

SECOND VICE-PRESIDENT—F. L. Peck, M.D., Surgeon N. Y. P. & O. R'y, Cllnton, N.Y.

SECRETARY—Webb J. Kelly, M.D., Division Surgeon Erie R'y, Galion, Ohio.

TREASURER—C. B. Kibler, M.D., Surgeon Erie R'y, Corry, Pa.

EDITOR—R. Harvey Reed, M.D., Chief Surgeon C. S. & H. R'y, Columbus, Ohio.

EXECUTIVE BOARD (one elected annually for a term of four years)—C. B. Parker, M.D., Surgeon L. S. & M. S. R'y, Cleveland, Ohio; term expires 1896. Milton Jay, M.D., Chief Surgeon C. & E. I. R'y, Chicago, Ill.; term expires 1897. M. Gardner, M.D., Chief Surgeon S. P. R'y, San Francisco, Cal.; term expires 1898. C. M. Daniels, M.D., Chief Surgeon Erie R'y, Buffalo, N.Y.; term expires 1899.

COMMITTEE ON TRANSPORTATION—W. J. Galbraith, M.D., Chief Surgeon U. P. R'y, Omaha, Neb.; Henry W. Coe, M.D., Surgeon N. P. R'y, Portland, Ore.; Wm. Thompson, M.D., Oculist Pennsylvania R'y, Philadelphia, Pa.

COMMITTEE OF ARRANGEMENTS—A. D. Bevan, M.D., Chief Surgeon Iowa Cent. R'y, Chicago, Ill.; D. S. Fairchild, M.D., Surgeon C. & N. W. R'y, Clinton, Iowa; W. A. Ward, M.D., Surgeon N. Y. C. & St. L. R'y, Conneaut, Ohio.

CHAPTER I.—EXECUTIVE SESSION.

PROCEEDINGS OF THE SECOND ANNUAL MEETING

OF THE

American Academy of Railway Surgeons.

WEDNESDAY, SEPTEMBER 25, 1895—AFTERNOON SESSION.

The Academy met in the Parlors of the Auditorium Hotel, Chicago, Ill., and was called to order at 2 P.M. by the President, DR. C. K. COLE, of Helena, Mont.

On motion of DR. WM. T. DALBY, Ass't Surgeon, U. P. R'y, Salt Lake City, Utah, seconded by DR. W. H. MEYERS, Surgeon B. & O. R'y, Meyersdale, Pa., the reading of the minutes of the last session was dispensed with. The Academy proceeded at once to scientific work.

After listening to the President's Address, a paper was read by DR. R. HARVEY REED, of Columbus, Ohio, on

A WORD ON THE MODERN USE OF THE TERMS INFECTION AND CONTAGION,

which was discussed by DRS. J. H. MAYNARD, Wyoming, L. E. LEMEN, Colorado, WM. THOMPSON, C. B. KIBLER, E. GRISWOLD, Pennsylvania, WM. T. DALBY, Utah, A. D. BEVAN, Illinois, and W. H. MEYERS, of Pennsylvania.

DR. WM. T. DALBY, of Salt Lake City, Utah, read a paper on the subject,

CAN WE IMPROVE UPON THE SANITARY CONDITION OF OUR CARS,

which was discussed by DRS. R. HARVEY REED Ohio, A. D. BEVAN, Illinois, J. H. MAYNARD, Wyoming, and W. J. GALBRAITH, Nebraska.

DR. W. J. GALBRAITH gave an extemporaneous talk on

AN AMPUTATION AT THE JUNCTION OF THE TARSAL AND METATARSAL ARTICULATIONS,

which was discussed by DRS. H. REINEKING, Wisconsin, J. H. MAYNARD, Wyoming, A. D. BEVAN, Illinois, R. HARVEY REED, Ohio, and C. B. KIBLER, Pennsylvania.

In the absence of DR. FRANK H. CALDWELL, of Sanford, Fla., his paper on

TRANSPORTATION OF INJURED EMPLOYES

was read by the Secretary, who also read a paper by DR. J. F. PRICHARD, of Manitowoc, Wis., on

PERSONAL EXPERIENCE IN SPINAL INJURIES,

after which the Academy went into executive session.

REPORT OF THE SECRETARY.

The following is a statement by DR. WEBB J. KELLY, Surgeon Big Four and Erie Ry's, Galion, Ohio, of the amount expended by him as Secretary during the past year:

EXPENDITURES.

Paper, envelopes, etc.	$13.10
Programs	15.00
Mailing proceedings	7.45
Stamps	29.70
Telegrams	4.00
Express, etc.	1.55
Clerk, 44 weeks at $2.00	88.00
Total	$158.80

RECEIPTS.

Nov. 5, 1894, Dr. C. B. Kibler	$50.00	
June 27, 1895, " "	25.00	
Sept. 24, 1895, " "	15.00	$ 90.00
Amt. due,		$68.80

As you will readily understand, this year the correspondence of the Secretary's office has been quite large. There is not a day that I do not receive two, three, four and five letters regarding fellowship in the Academy. I have endeavored to answer this correspondence in a manner that would be perfectly satisfactory to the Academy. It may be interesting to know that we could have here to-day 300 applications were we to solicit in the least, or were we to even give encouragement to a large class of railroad surgeons that would be of no benefit

to the Academy, nor of any benefit to the railway surgical management, and I have endeavored to treat all the Fellows, and those applying for fellowship, as courteously as was possible during all this correspondence.

THE PRESIDENT.—If there is no objection, the report of the Secretary just read will be received and referred to the Executive Council for report later on. My attention has been called, gentlemen, to the death of DR. MCGANNON, of Brockville, Ontario, a Fellow of this Academy, and I am not certain that there may not have occurred other deaths during the year. It would be well to have a special committee on necrology appointed, perhaps, to take action at this session. What is your pleasure?

It was moved by DR. DALBY that a committee of three on Necrology be appointed. Seconded by DR. GALBRAITH, and carried.

The President appointed the following; DR. A. D. BEVAN, Chicago, Ill.; DR. W. H. MEYERS, Meyersdale, Pa., and DR. HENRY W. COE, Portland, Oregon.

DR. BEVAN stated that PROF. ETHERIDGE, of the Presbyterian Hospital, invited the Academy to be present at a clinic in his operating room at 8 o'clock the following morning.

It was moved by DR. REED, of Ohio, and seconded by DR. MAYNARD, of Wyoming, that the invitation be accepted. Carried.

The report of the Treasurer, DR. C. B. KIBLER, Surgeon, N. Y., P. & O. R'y, Corry, Pa., was read, and is as follows:

To the Fellows of the American Academy of Railway Surgeons:

Your Treasurer begs to report, that he has received membership dues up to this date $332.00

CR.

Voucher No. 1, Nov. 14, 1894, Dr. R. Harvey Reed . .	$ 29.00		
" " 2, Nov. 24, 1894, Dr. Webb J. Kelly . . .	50.00		
" " 3, Dec. 30, 1894, Dr. R. Harvey Reed . .	10.00		
" " 4, Jan. 3, 1895, Express charges	.35		
" " 5, Jan. 3, 1895, Postage and envelopes.	5.00		
" " 6, Jan. 26, 1895, W. J. Morgan.	35.00		
" " 7, Feb. 28, 1895, A. C. Berlin & Co. . . .	7.13		
" " 8, Dr. Webb J. Kelly.	25.00		
" " 9, July 27, 1895, Dr. R. Harvey Reed . .	6.49		
" " 10, Aug. 19, 1895, Dr. J. B. Hamilton . . .	100.00	$267.97	

Leaving a cash balance in hands of the Treasurer of . . . . $ 64.03

The Treasurer's report was referred to the Judicial Council for auditing and report.

Adjourned until 10 o'clock, Thursday, September 26.

THURSDAY, SEPTEMBER 26, 1895—MORNING SESSION.

The meeting was called to order by PRESIDENT COLE at 10 A.M.

The reading of the minutes was dispensed with.

The President stated that an executive session would be the special order of business the first thing in the afternoon.

A paper was then read by DR. W. H. BUECHNER, Surgeon, Erie R'y, Cleveland, Ohio, on

AMPUTATION AT THE KNEE JOINT,

which was discussed by DRS. C. M. DANIELS, New York, L. E. LEMEN, Colorado, MILTON JAY, Illinois, J. H. MAYNARD, Wyoming, E. GRISWOLD, Pennsylvania, M. GARDNER, California, JOHN E. OWENS, Illinois, F. H. PECK, New York, and closed by the author.

DR. J. W. PERKINS, of Kansas City, Mo., read an able paper on

BRAIN INJURIES; THEIR MECHANISM AND SYMPTOMS, WITH SPECIAL REFERENCE TO EXACT DIAGNOSIS AND TREATMENT,

which was followed by an interesting discussion, participated in by DRS. MILTON JAY, Illinois, E. GRISWOLD, Pennsylvania, HENRY HATCH, Illinois, HENRY W. COE, Oregon, C. K. COLE, Montana, F. H. PECK, New York, C. M. DANIELS, New York, and closed by the author, after which the Academy adjourned until 2 P.M.

THURSDAY, SEPTEMBER 26—AFTERNOON SESSION.

The Academy opened in executive session at 2:15 P.M.

DR. C. K. COLE in the chair.

The executive Board reported having audited the reports of the Secretary and Treasurer, and found they were correct in every particular.

On motion of DR. F. H. PECK, of Utica, N. Y., seconded by DR. WM. T. DALBY, of Salt Lake City, Utah, the report of the Executive Board, inasmuch as it related to these reports, was adopted.

The Executive Board reported the following applicants for the consideration of the Academy:

Dr. F. K. Ainsworth, Surgeon, Southern Pacific R'y, Los Angeles, Cal.

Dr. M. Gardner, Chief Surgeon Southern Pacific R'y, San Francisco, Cal.

Dr. G. E. Benninghoff, Surgeon, W. N. Y. & P. R'y, Bradford, Pa.

Dr. Herbert B. Tanner, Surgeon, C. & N. W. R'y, Kaukauna, Wis.

Dr. W. A. Ward, Surgeon, N. Y., C. & St. L. R'y, Conneaut, Ohio.

Dr. H. Reineking, Surgeon, C. & N. W. R'y, Sheboygan, Wis.

Dr. Geo. W. Harrison, Surgeon, C. & N. W. R'y, Ashland, Wis.

Dr. D. S. Fairchild, Surgeon, C. &. N. W. R'y, Clinton, Iowa.

Dr. Frederick D. Barker, Surgeon, C., H. & D. R'y, Dayton, Ohio.

Dr. R. P. Izlar, Surgeon, Plant System of Ry's, Ocala, Fla.

Dr. Amos Walker Barber, Surgeon, U. P., D. & G. R'y, Cheyenne, Wyo.

Dr. C. B. Lyman, Assistant Division Surgeon, U. P. System, Denver, Colo.

Dr. Fred J. Hodges, Chief Surgeon, C. & S. E. R'y, Anderson, Ind.

Dr. S. C. Baldwin, Surgeon, G. S. L. & H. S. R'y, Salt Lake City, Utah.

Dr. Edward M. Dooley, Surgeon, N. Y., L. E. & W. R'y, Buffalo, N. Y.

Dr. H. W. Thayer, Surgeon, W. N. Y. & P. R'y, Corry, Pa.

Dr. E. H. Trickle, Surgeon, T. & O. C. R'y, Cutler, Ohio.

Dr. E. Wyllis Andrews, Surgeon, Wabash R'y, Chicago, Ill.

Dr. Henry Hatch, Surgeon, C., B. & Q. R'y, Quincy, Ill.

Dr. C. P. Thomas, Surgeon, E. & M. C. R'y, Everett, Wash.

Dr. W. O. Daniels, Principal Surgeon, Georgia Penitentiary, Atlanta, Ga.

Dr. A. G. Thompson, Assistant Oculist, Penna. R'y, Philadelphia, Pa.

On motion of DR. WEBB J. KELLY, of Galion, Ohio, seconded by DR. L. E. LEMEN, of Denver, Colo., the applications were balloted on in sections of five.

cost of preparing the same could be had, according to the amount of material therein, and should the number of pages exceed 350, the pages in excess to be paid for at the rate of 42 cents a page for such additional pages, provided full payment be made within thirty days after publication of transactions.

Faithfully yours,

JOHN B. HAMILTON, Editor.

This proposition was recommended by the entire Publication Committee.

On motion of MR. A. D. BEVAN, of Chicago, seconded by DR. WM. T. DALBY, of Salt Lake City, Utah, the proposition of the JOURNAL was accepted, and on further motion of DR. DALBY, seconded by DR. F. H. PECK, the matter of drawing up the contracts and of the number of volumes of transactions to be published was left to the judgment of the Publication Committee.

On motion of DR. A. D. BEVAN, seconded by DR. F. H. PECK, the executive session was declared dissolved and the Academy resolved itself into a scientific body.

The HON. TRACY C. BECKER, of Buffalo, N. Y., being present, delivered his address on medico-legal surgery, the title of which was

SOME OBSERVATIONS CONCERNING THE LAW OF PRIVILEGED COMMUNICATIONS BETWEEN THE PHYSICIAN AS APPLICABLE TO THE DUTIES OF RAILWAY SURGEONS.

It was moved by the Secretary that a vote of thanks be tendered MR. BECKER for his kindness in preparing the paper. Carried unanimously.

DR. GRISWOLD read a communication from DR. HOLLINGER, and offered some resolutions in regard thereto, which resolutions, on motion of DR. DALBY, seconded by DR. PECK, were laid on the table.

FRACTURE OF THE FOREARM, COMPLICATED WITH DISLOCATION

is the subject of a paper read by DR. E. GRISWOLD, of Sharon, Pa.

DR. BEVAN asked permission to read his paper at this time, and have the two discussed together.

Consent was given by DR. GRISWOLD and the Academy, and

DR. A. D. BEVAN, Chief Surgeon, Iowa Central R'y, Chicago, Ill., read a paper on

AN EXPERIMENTAL AND CLINICAL STUDY OF COLLES' FRACTURE,

which was discussed by DR. E. GRISWOLD, of Pennsylvania, after which it was moved by DR. PECK that the thanks of the Academy be tendered to DR. BEVAN for his very complete elucidation of a very important subject. Seconded and carried. DR. F. H. PECK, of Utica, N. Y., read a paper on

AN UNUSUAL CASE OF FRACTURE OF THE SKULL,

which was discussed by DR. DALBY, of Utah.

VERDICTS OBTAINED THROUGH PERJURY

is the subject treated on in a paper by DR. C. B. KIBLER, of Corry, Pa., and discussed by DRS. BECKER, HENRY HATCH, Illinois, M. GARDNER, California, J. H. MAYNARD, Wyoming, and WM. H. DALBY, Utah.

Before the session closed, the President, DR. C. L. COLE, informed the Academy that DRS. W. J. GALBRAITH, R. HARVEY REED, W. R. BLAKESLEE, A. D. BEVAN and himself had been called to Omaha to testify in a very important suit which was then pending against the Union Pacific Railway Company in the United States Court, and asked the consent of the Academy to leave. The consent was given.

On motion the meeting adjourned until 10 o'clock the following morning.

FRIDAY, SEPTEMBER 27. MORNING SESSION.

DR. C. M. DANIELS in the chair.

A paper was read by DR. JOHN E. OWENS, chief surgeon, C. & N. W. R'y., Chicago, Ill., on

WHAT SHOULD EXCLUDE APPLICANTS FROM RAILWAY SERVICE?

DR. WEBB J. KELLY, of Ohio, opened the discussion, and was followed by DRS. F. K. AINSWORTH, California, D. S. FAIRCHILD, Iowa, and closed by the author.

DR. L. E. LEMEN, of Denver, Colo., read a paper on

SANITARY REGULATIONS GOVERNING RAILWAYS,

which was discussed by DR. C. M. DANIELS, of Buffalo, N. Y. This was followed by a paper on the

BEST METHOD OF OBTAINING THE BEST POSSIBLE ASEPTIC CONDITION DURING OPERATIONS DONE IN PLACES OTHER THAN HOSPITALS,

by DR. J. F. REGER, Littleton, W. Va. DR. HENRY W. COE, of Oregon, opened the discussion on this paper, which was participated in by DRS. L. E. LEMEN, Colorado, F. J. HODGES, Indiana, C. M. DANIELS, New York, WM. T. DALBY, Utah, E. GRISWOLD, Pennsylvania, and closed by the author.

Vice-President C. M. DANIELS, of Buffalo, N. Y., read a paper on

THE USE OF COCAIN IN MINOR AMPUTATIONS,

which was discussed by DRS. E. GRISWOLD, Pennsylvania, HENRY W. COE, Oregon, WEBB J. KELLY, Ohio, L. E. LEMEN, Colorado, F. J. HOGES, Indiana, JOHN E. OWENS, Illinois, and closed by DR. DANIELS.

THE USE OF GOLD FOIL IN FRACTURES OF THE CRANIUM AND RESULTING HERNIA CEREBRI

is the subject of a very able paper written by DR. W. L. ESTES, of South Bethlehem, Pa., which was read by the Secretary, and discussed by DRS. WM. T. DALBY, Utah, HENRY W. COE, Oregon, and HENRY HATCH, Illinois.

DR. FRED J. HODGES, of Anderson, Ind., read a paper on

CONTINUOUS SUBMERSION IN THE TREATMENT OF INFECTED WOUNDS OF THE EXTREMITIES,

which was discussed by DRS. HENRY HATCH, of Illinois, WEBB J. KELLY, Ohio, L. E. LEMEN, Colorado, C. M. DANIELS, New York, and closed by the author.

FRIDAY, SEPTEMBER 27. AFTERNOON SESSION.

DR. C. M. DANIELS in the chair.

The next thing in order being the election of officers, the chair appointed DR. L. E. LEMEN, Denver, Colo., and DR. HENRY W. COE, Portland, Ore., tellers.

A ballot for President was then ordered and resulted in the election of DR. JOHN E. OWENS, Chicago, Ill.

The ballot for First Vice-President was then ordered and resulted in DR. L. E. LEMEN, Denver, Colo., being elected on the second ballot.

The ballot for Second Vice-President was then ordered and resulted in the election of DR. F. H. PECK, Utica, N. Y.

The ballot for Secretary was then ordered and DR. WEBB J.

KELLY, of Galion, Ohio, having received the majority of votes, was declared elected Secretary.

The ballot for Treasurer was then ordered and resulted in the election of DR. C. B. KIBLER, Corry, Pa.

DR. R. HARVEY REED, Columbus, Ohio, was unanimously elected Editor.

DR. JOHN E. OWENS, Chicago, Ill., and DR. L. E. LEMEN, Denver, Colo., having been elected to the offices of President and First Vice-President, respectively, tendered their resignations as members of the Executive Board, which were accepted.

DR. R. S. HARNDEN'S membership on the Executive Board having expired, a ballot was ordered for the election of a member for four (4) years, which resulted in the election of DR. C. M. DANIELS, Buffalo, N. Y., on the second ballot.

A ballot was then ordered for the election of a member of the Executive Board to fill the unexpired term of DR. JOHN E. OWENS, which resulted in the election of DR. M. GARDNER, San Francisco, Cal., who was declared elected for three (3) years.

A ballot was then ordered for the election of a member of the Executive Board to fill the unexpired term of DR. L. E. LEMEN, which resulted in the election of DR. MILTON JAY, Chicago, Ill., on the second ballot.

On motion of DR. WEBB J. KELLY, seconded by DR. J. F. REGER, it was decided that the next meeting be held in Chicago.

On motion of DR. F. H. PECK, seconded by DR. C. B. KIBLER, the selection of the time in September was left to the Publication Committee and the Committee on Arrangements.

A telegram was read from the Chamber of Commerce of Denver, MAYOR MCMURRAY and GOVERNOR MCINTYRE of Colorado, extending an invitation to the Academy to meet in Denver in 1896.

DR. J. F. REGER gave notice of a resolution to change the Constitution in regard to the selection of Honorary Fellows.

The Committee on Necrology having made no report, were given until the next meeting to perform their duty.

On motion the Academy adjourned, to meet in Chicago in September, 1896.

C. M. DANIELS, M. D.,

BUFFALO, N. Y.

First Vice President American Academy of Railway Surgeons;
Chief Surgeon W. N. Y. & P. Ry.

Chapter II.—President's Address and Miscellany.

PRESIDENT'S ADDRESS.

BY C. K. COLE, M.D.
CHIEF SURGEON MONTANA CENTRAL RAILWAY.
HELENA, MONT.

Fellows of the American Academy of Railway Surgeons:—I congratulate you, and through you the railway hospital service of the country, upon the evidences of success and prosperity attained by your association in the short space of one year. A year ago the need of such an association as this Academy was by many doubted, by a few urgently denied, and by those few the proposition to effect an organization was violently opposed. For the most part it is fair to assume that the opposition, whether merely passive or as in certain instances quite active, reflected the honest sentiments of those who were equally desirous in the interests of railway surgery, as were those of us who felt the time ripe for the consummation of what had long been considered desirable, if not an actual necessity. No stronger justification of the wisdom of the undertaking and no better vindication of the motives which prompted the promoters, could be desired, than the events which have transpired touching the interests of the Academy during the past eighteen months, and I may add no greater inspiration is

needed to a continuation of honest, loyal work in the future along the lines governing this association than a glance at the splendid scientific program for this meeting, and the additional fact that 85 per cent. of the Fellows of the Academy are present to participate in our proceedings.

Gentlemen, while these are matters for congratulation, and calculated to stir us with enthusiasm in behalf of our organization, let us not take a narrow conception of our work, which, as Fellows of the Academy, is necessarily national in its character. Let us rather seek by individual effort to promote a proper spirit of competition, remembering that as individuals and also as a society we will be carefully and accurately judged by public opinion, as well as by our own consciences, than which no higher or more impartial court ever found a verdict.

In this era of verbosity in medical literature it is often extemely difficult even with those of large experience, as well as extensive personal acquaintance, to select the really good from that which is mediocre in what is written. An important function of this Academy is to seek to establish a standard in the literature of railway surgery in America. I undertake to say that if each gentleman in affiliation with the Academy would give the same painstaking attention to what he writes for publication as he does to his ordinary professional duties, never lending himself to the popular idea of writing frequent lengthy and often empty articles for print, the literature of the Academy would in a few years be recognized as trustworthy and authoritative in matters pertaining to railway surgery, and its Fellows would be credited with having established

an institution worthy of commemoration. The erstwhile mooted question as to establishing railway surgery as a specialty requiring special aptitude, special training and special facilities for work, is rapidly being settled, and it is safe to predict that in the near future, railway surgery as a specialty will be firmly established in the minds of not only the medical profession generally, but of also those distinguished laymen who have to do with the building and management of our great railways. Specialism in railway surgery does not consist in the use of certain apparatus, instruments, dressings, etc., nor does it consist in the possession of any peculiar technical knowledge not necessary to the general surgeon, for we are all governed by well-established surgical laws, and the application of certain cardinal principles is the same, whether in railway, military or other emergency surgery. It can not, however, be denied that in matters of organization and equipment, including transportation of patients, and many other details peculiar to railway surgery, special qualifications are essential to the best success. The general or chief surgeon of a road must have certain mental characteristics, not the least important of which is executive ability of a high order, together with a judicial instinct which will enable him under all circumstances to be fair and impartial to all concerned. He must, moreover, command the respect and confidence of his *confrères* generally and especially of his local surgeons, many of whom will be found to be his superior in point of operative ability, and each of whom should be a reputable practitioner in the best sense of the term.

I trust I may be forgiven the apparent, if not the

real egotism of assuming to inflict so much parental advice, and beg in extenuation to say that the impulse is born of a deep feeling of interest in the present and future welfare of this association. We are making history, and it depends upon ourselves whether the future shall reveal the wisdom or unwisdom of our actions. This Academy is no longer an experiment with an uncertain future but an assured fact, and if we carefully observe the tenets of our organization there can be no doubt as to the ultimate result of our labors.

Generally speaking, the medical press throughout the country have been kind and courteous to us. The same may be said of the management of our various railways, which have almost without exception commended the general scheme of our organization, and especially the distinctive features of a strictly limited membership, with rigid scrutiny as to the qualification and standing of every applicant for fellowship.

I desire to express thanks to my associates in office especially, and to each of you for the very efficient service rendered during the past year. For myself, the honor of having served as your first President is sufficient recompense for whatever effort the filling the position has cost.

WHAT SHOULD EXCLUDE APPLICANTS FROM RAILWAY SERVICE?

BY JOHN E. OWENS, M.D.
CHIEF SURGEON CHICAGO AND NORTHWESTERN AND ILLINOIS CENTRAL RAILWAYS.
CHICAGO, ILL.

It is a matter of practical interest to determine what should and what should not exclude applicants from railway service.

The formulation of any set of rules intended to govern examinations presupposes the adoption of a working basis, and the classification of the applicants for service.

So far as disabling diseases are concerned, it will not be necessary to mention those which are so disabling as to discourage the sufferer from following any pursuit. Others, again, are more or less insidious in their progress and for a time do not furnish symptoms which make the patient aware of their existence. Certain conditions interfere with the healing of wounds, impede recovery, entail an undue loss of time, and become aggravated by the injuries which are received in the line of duty. It would be useless to enumerate all the diseases which would disable the applicant. From a medical standpoint the following will perhaps be sufficient to turn the attention of the medical examiners in the right direction: Diabetes, cancer in all its forms and in all localities, chronic diarrhea, the presence of gallstones, chronic inflammations, hem-

optysis, tuberculosis, asthma, organic cardiac disease, evidences of organic disease of the brain and its meninges and of the spinal cord.

From a surgical standpoint the following should exclude the applicant from service: Necrosis, ulcerations in any region, scrofula, bubo, malignant tumors, phlebitis, varicose veins, aneurysm, acute and chronic periostitis, synovitis, arthritis, floating cartilages, old depressed fractures of the skull, or any fracture followed by head symptoms, suppurative ear diseases, antero-posterior spinal curvature, severe injuries of the back, recurring appendicitis, abdominal hernias, acute and chronic cystitis, acute gonorrhea, epididymitis, enlarged testicle, certain visual defects and deafness.

INSTRUCTIONS GOVERNING SURGEONS IN CONDUCTING EXAMINATIONS OF APPLICANTS FOR EMPLOYMENT ON RAILROADS.

When making application for service, engineers, firemen, agents, operators, conductors, brakemen, engine dispatchers, train baggagemen, station baggagemen, crossing flagmen, switchmen, switch tenders and signalmen must be examined for color perception, hearing, and for visual and other physical defects.

Examining surgeons are requested to select a time and place at which they will conduct examinations, and to notify the proper officer.

Examinations are to be conducted in a well-lighted room at least twenty-two feet in length. In testing visual acuteness, only one applicant should be present in the room at a time. In testing color perception and hearing, any number of applicants may be present, but must maintain silence.

Examining surgeons are provided with the following articles to be used in making examinations:

1. Two cards of test type (Snellen's). (One for illiterates.)

2. A set of wools for testing color perception.

Applicants will bring with them application forms *in duplicate* on which will be found a blank certificate, to be filled out and signed by the examining surgeon.

EXAMINATIONS IN VISUAL ACUTENESS.

The card of test types should be fastened in a good light to a wall, the bottom of a card being about five feet from the floor.

A distance of twenty feet should then be measured off on the floor at a right angle to the plane of the card. Applicants are then to be admitted singly and instructed to read the card from above downward without assistance. In cases of defective vision, after testing vision for both eyes, each eye should be tested separately. The last five letters read correctly are to be recorded in the report.

Examiners are reminded that the normal-eyed should read at twenty feet the line marked 6 m.

EXAMINATION IN COLOR PERCEPTION.

Examiners are furnished with a set of colored wools, lettered A, B, and C, and numbered from 1 to 40. These wools are divided into three groups, distinguished as follows:

Group A, containing the light green skein A, the green shades numbered 2, 4, 6, 8, 10, 12, 14, 16, 18 and 20, and the gray confusion colors numbered 1, 3, 5, 7, 9, 11, 13, 15, 17 and 19.

Group B, containing the pink or purple skein B, the

pink or purple shades numbered 22. 24. 26. 28 and 30, and the blue confusion colors numbered 21. 23. 25, 27 and 29.

Group C, containing the red skein C. the red shades numbered 32, 34. 36. 38 and 40. and the brown confusion colors numbered 31. 33. 35. 37 and 39.

MANNER OF USING THE WOOLS.

Mix the forty skeins thoroughly and throw them on a table in a good light: select skein A. and, placing it about twelve inches distant from the pile of wools, instruct the applicant to pick out the different shades of the same color.

The examiner, having satisfied himself of the ability or inability of the applicant to select the proper skeins, should record the numbers of the skeins selected and return them to the pile. The examiner should then place the skeins B and C successively near the pile of wools, to be treated in the same manner.

In testing for defects in color perception, examining surgeons may be guided by the following brief suggestions:

1. Any number of applicants may watch the test in operation, provided they maintain silence. In case an applicant fails to comprehend the test, he may be directed to step aside and watch another applicant select the skeins, or in the absence of another applicant the surgeon may himself make the selection. This method is valuable in case of color blindness, as the applicant is convinced against his will that the test is a fair one.

2. Do not under any circumstances call the color of a skein. All tests in which the applicant is requested

to name colors or shades are incorrect. The object of the test is to discover whether the applicant can properly classify shades of primary colors, and it is important after he thoroughly understands what is expected of him not to render him any assistance.

3. It is well, if necessary, to explain the difference between colors and shades, for example: Blue, green, red, are colors. Light blue, dark blue, pea green, Venetian red, are shades of these colors.

The examiner should watch the applicant closely and note any hesitancy in selecting the skeins, especially when he appears undecided whether or not to select a confusion color. Should he evince a strong tendency to select any confusion color, even if he does not actually select it, the number of the color should be recorded. Those who are defective in color sense, either select the confusion colors or want to do so.

4. Recollect, however, that blue is not a confusion color for green but only for pink (purple). It must be borne in mind that many men, not particularly ignorant in other matters, find it difficult to distinguish between light shades of blue and green, or between red and orange. This defect is one merely of education. It is the result of color ignorance, but not of color blindness, and should not reject a candidate. In case such ignorance is manifested, it may be well to call the applicant's attention to the fact that he is not well posted in colors.

5. In case of color blindness, the applicant usually adopts one of two courses. He may boldly and rapidly select a number of skeins at random, throwing them down with a great show of confidence, or he will

laboriously study over the skeins, carefully selecting a few of the correct colors, and a few—often not more than one—of the confusion colors, always hesitating and usually selecting shades of nearly the same intensity in color and confusion of colors, for example: light green, light gray, light purple and light blue.

The infirmity of applicants adopting the first course is usually easy to detect, but it is often difficult to distinguish between a man who is hesitating and vacillating on account of lack of purpose or color ignorance, and one who does so on account of actual deficiency in color perception. In these latter cases it is well to instruct the applicant not to handle the wool until he has determined what skein he wishes to select. The applicant may also be permitted to watch another while making the test.

6. In case more than one applicant is present during the examination the wools should be frequently mixed, and other applicants should stand far enough from the table to be unable to read the numbers on the skeins, or the skeins may be arranged with the numbers turned down.

Inasmuch as the duties for the different railway employes are widely different, the requirements for efficient service would likewise vary. It would therefore be judicious to formulate the following classification:

In the first class, or those with normal hearing, color sense and visual power, are included the following: Engineers, firemen, engine dispatchers, brakemen, signalmen, conductors and train baggagemen.

In the second class, in which normal color sense and normal hearing are demanded, and also perfect visual power in one eye, while the other might attain

to only 20-40 of the standard, or 20-30 visual power in both eyes, or both of which may be made so by the use of glasses, are included switchmen, switch tenders, agents, operators, station baggagemen and crossing flagmen, or gatemen.

PHYSICAL DEFECTS.

1. Applicants with trachoma or other inflammatory conditions of the eyes, or with chronic discharges from the ear, are disqualified.

2. Hernia, varicose veins of both legs, or very marked varicosity of veins in one leg, phlebitis, skin diseases—especially eczema, or even a strong tendency to it, loss of entire thumb or loss of two fingers of one hand, disqualify the first class, and station baggagemen, switchmen and switch tenders in the second class, while crossing flagmen, agents and operators may be accepted with hernia and also with loss of thumb or loss of two or more fingers of one hand.

3. Unmistakable evidence of chronic alcoholism disqualifies both classes.

4. Acute gonorrhea and the primary and secondary manifestations of syphilis, traumatic and pathologic bubo, disqualify both classes as long as the symptoms are apparent.

5. Orchitis, epididymitis, malignant tumors, recurring appendicitis, old depressed fractures of the skull, or any fracture followed by head symptoms; spinal injuries, epilepsy, antero-posterior curvature, severe injuries of the back, tuberculosis, marked scrofulous cachexia, aneurysm, necrosis, acute and chronic periostitis, acute and chronic cystitis, disqualify both classes. Agents, operators and crossing flagmen may

be accepted with antero-posterior curvature without symptoms.

6. While synovitis, arthritis, floating cartilages and impaired mobility of joints disqualify the first class, and switchmen, switch tenders and station baggagemen in the second class, the latter need not exclude agents and operators, provided inflammation has long since subsided and the affected joints be free from pain.

7. From a medical standpoint, diabetes, chronic rheumatism and gout, chronic diarrhea, chronic hepatic disorders attended with jaundice, are disabling in their nature; hepatic, cardiac or renal dropsies, asthma, hemoptysis, valvular disease of the heart, angina pectoris, evidences of organic disease of brain or spinal cord, insolation, inveterate neuralgia of the larger nerves, disqualify both classes, while crossing flagmen may be accepted with a moderate amount of chronic rheumatism.

8. Under the head of disqualifying defects, surgeons will be careful to note any physical defects that would impair the usefulness of the applicant, that would be more or less aggravated by the service, or would contribute to the prolongation of disability in case of injury.

9. In order to prevent fraud in subsequent claims for personal injury, a careful record must be made in the proper place of physical defects which do not impair the usefulness of the applicant, that would not be aggravated by the service, or would not contribute to the prolongation of disability in case of injury.

10. In case the applicant does not show evidence of having been vaccinated since attaining to adult years, he should be vaccinated.

After making the test of vision, color perception, hearing and examination for physical defects, the examination surgeon will fill out and sign in duplicate the blank certificate found on the application blanks. One of these is sent to the Division Superintendent or Master Machanic. and the other to the Chief Surgeon. The fee for making such examination will be paid by the company unless the applicant is accepted as an employé, in which case the amount of the fee is deducted from his wages. The certificate referred to is as follows:

SURGEON'S CERTIFICATE.

(Here follows a list of stations where examinations may be made.)

The following is the report of the result of my examination of Mr. . . . . .

1. When placed at a distance of twenty feet from the test types, the last five letters read correctly by the applicant are: Right eye, ... ; left eye, ... ; both eyes, ...

2. A. The applicant selects skeins numbered as follows, as being the same color as test skein A: . . . . . B. The following as being of the same color as test skein B: . . . . . C. The following as being of the same color as test skein C: . . . . .

3. The applicant hears the tick of a watch with the right ear at . . . . . inches; with the left ear at . . . . . inches. For ordinary conversation at a distance of twenty feet, the hearing is . . . . . impaired.

I hereby certify that, having examined the visual power, color perception and sense of hearing of the applicant, I find him { qualified / disqualified } to fill the position of . . . . .

I also certify that there is evidence of his having been successfully vaccinated, that he is not suffering from any disease or disability, nor does he manifest any evidence of an abuse of intoxicating liquors.

Disqualifying defects . . . . . ; defects that do not dis-

qualify . . . . . (Signed.) . . . . . , Surgeon.
Dated at 189

In presenting this paper, my desire is to formulate a tentative working basis for the purpose named. In all probability its practical working will suggest useful changes, and I am glad to avail myself of this opportunity for conference with the able Fellows here present, and hope that they will make important suggestions.

DISCUSSION.

DR. WEBB J. KELLY—I was very much interested in the paper of Dr. Owens, probably on account of the fact that in Ohio the railways have to a certain extent evaded the law. The law compels them to have the test for color blindness made, and it has been the custom of some roads—I will not say all—to select some one of the trainmasters to make the examination. The doctor in his paper calls attention to one point that impressed me very much, and I think the management of railways should have their attention called to it, namely, not designating what color they are to select as a color, giving it the name. As the doctor says, the test color is placed on the table and then the parties to be examined are asked to select the colors that match it. I have known instances that have come up on one of the roads I represent in which an employe would be examined for color blindness, and he would be asked to pick out all the greens in the bunch, and in that way the examiner would get the man confused. Were he to take the original green and ask the man to match it, I have no doubt the man would have done it correctly. I think this an important point in the doctor's paper to which we should call the attention of the management of our roads where they do not have a regularly employed surgeon to make these examinations.

DR. F. K. AINSWORTH—There is very much to commend in the paper of Dr. Owens and very little to criticise. I would ask the doctor what he does in the case of crippled employes? For instance, a man is employed in some branch of the railway service who has not had an examination for color perception, etc., who has lost a leg or some other member, and the com-

pany is anxious to do something for him—what can be done in such case? Under the rules of Dr. Owens that man could not become a flagman. It is becoming a question what to do with the crippled employes of our railroads. We have filled the positions of flagmen with these men, or in some cases with old engineers who are unable to do anything else.

In regard to the test for color perception, the doctor's rules are the same practically as ours, and I will only speak of one point that seems of great value. I have many times had men fail in the color test when made by the worsteds. Of course, in many instances I believe it was due largely to ignorance of colors, while in others it was attributable in greater or less degree to color blindness. These men, if given low surface flags, can pick them out every time without making any errors. They can pick them out in a dark room. If a man recognizes smoky lights without error, I should think it would be safe enough to put him on duty even if he had failed in distinguishing the wools.

Dr. D. S. Fairchild—Beginning with this month I have examined two hundred men under the regulations which have been adopted by Dr. Owens, and I have been astonished at the number of men who could not come up to the standard. Out of fifty-one men examined, twenty-four of them had either defective vision, defective hearing, or had large abdominal rings. Now, I have been making a note of all those cases in which there were large addominal rings. While these men are not disqualified, as far as the railway service is concerned, it is quite possible that some time in the future difficulty will develop. It not infrequently happens that an injured man, either a switchman or brakeman, comes into our office and says he was hurt in consequence of trying to climb on a moving train. The round of the ladder gave way, he fell, and hernia followed. Now, it is quite possible that such a man had weak abdominal walls previous to this time, that the hernial rings were large, and that in consequence hernia was developed and the railway company has to pay for an injury which they ought not to pay for. I do not know what regulations Dr. Owens makes in regard to the acceptance of candidates who have such abdominal rings. To my mind, in a certain sense it would be disqualifying evidence. I have observed that men over 30 years of age,

in a large percentage of the cases examined, had defective vision, and that 20-30 was about as far as they could see with both eyes. I find also in a number of instances that vision in one eye would be 20-30 or 20-40, or in both eyes 20-20.

In regard to the color test, I have observed a good deal of ignorance on this subject, and if the applicants were required to name the colors there would be many that would be considered color blind. To mention color does away with the element of ignorance. The candidate on being asked to select the skeins at once says he has been engaged in the kind of work that enables him to learn different colors. Not a few clerks in a drygoods store fail in naming certain colors. He has to simply select two colors and all shades of those colors, and in this way he is able to determine what belongs to the reds and the greens and avoid putting in any combination colors with them. Out of fifty-one cases examined, I found one candidate color blind, and one with a fully developed direct inguinal hernia with an extremely large external ring on either side, which would permit of the introduction of two fingers. I found one case of mitral insufficiency with compensatory hypertrophy. In this case the condition would not disqualify him for employment now, but of course the compensatory hypertrophy would be against him sooner or later. On our road the superintendent is required to have all applicants undergo this examination. When the slack time came last year and year before, instead of laying these men off for a period of time, they were discharged, but were obliged to seek reëmployment under the same rules that new or recent applicants would have to observe. These men have all been examined, and I think it is the intention of our superintendent, so far as he has jurisdiction over the matter, not to employ any men over 30 years of age unless they come up to a high standard, and as previously stated, I have observed that those men who are over 30 years of age have some defect of vision.

There is another point in regard to hearing. We find men in the engineering department—I mean the locomotive engineering department—employed as either firemen or otherwise, in the machine shops, who have defective hearing so far as the watch is concerned. In some cases they can hear a watch tick only eight or ten inches, in one case I recall only four inches, and

in another the man could only hear the watch tick two inches distant from one ear, and not at all with the other ear; yet the hearing at a distance did not seem to be materially defective. I requested this last candidate to have a specialist examine his ears and determine whether or not there was any disease of the organ. The aurist returned a written report saying that there was no disease of the ear, and that the watch test was not a fair one in this case; that he could hear eaaily at a distance of twenty feet, whereas he could not hear the watch at all with one ear, and with the other only a distance of two inches. The opportunity of making these examinations has revealed to me a risk which railway companies have taken heretofore in employing men in this capacity, so far as their physical condition of hearing and seeing is concerned.

Dr. Owens (closing the discussion)—This matter of examining applicants for the railway service is an exceedingly important one, and I might say that an examiner is not made in a day. When I first took the matter up, it took me some three months to investigate it, before I felt justified in doing this important work. Now, we have examiners on our roads who do not really know how to examine these men. Perhaps I ought to be ashamed to say it. I know they will be able to do it after a while. The reports come to me and I pass on them. If there is anything wrong we rectify it in some way. How can we get our examiners to thoroughly examine these applicants? In the first place the matter must be thoroughly studied. I have recently come in contact with the report of a committee of the Royal Society of London on this subject. It takes the subject up in all its relations, criticising the methods of the Board of Trade which seem to be so very defective that they were not accepted at all. It is one of the most valuable pamphlets on the subject that I know of. Then there is a book just issued, the "Dalton Lectures," which treats of the subject of color blindness. There are various text-books on diseases of the eye that one may pick up, but they do no not go into the subject of color blindness to a sufficient extent to enable the examiner to do his work well. I intend to get a number of these reports and will have the surgeons connected with our roads procure them through us.

It is said that applicants who have made some mistakes with

worsteds are able to name the colors of the flags and the lanterns correctly. The question is whether a man who makes mistakes with worsteds and does not in the case of flags and lanterns should be accepted. That throws into the examination the naming of colors which is a defective method. On the Illinois Central Road the examinations were made first with worsteds, and then Mr. Jeffrey ordered that the examinations be repeated, and the applicants were examined with flags and lamps. I was timid as to the efficiency of the latter method. My assistant, Dr. Allport, of the Illinois Central Road, has examined many applicants with flags and lanterns, as well as with worsteds. The conclusion has been reached that men who are color blind with worsteds will make mistakes with flags and lanterns.

W. H. ELLIOTT, M. D.,

SAVANNAH, GA.

Second Vice President American Academy of Railway Surgeons; Chief Surgeon Central Railway of Georgia.

TRANSPORTATION OF INJURED EMPLOYES.

BY FRANK H. CALDWELL, M.D.,
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SANFORD, FLA.

The preliminary treatment given the employe or passenger at the time of accident, resulting in injury, and before the patient is removed to his home or to the hospital, is a service of vital importance; but the scope of this paper will not permit its discussion. The writer intends to confine himself strictly to the subject, as outlined for him by your committee.

Considering the importance of transportation of persons injured it would be natural to suppose that there exists some literature on the subject, but a careful search has failed to reveal any material which could be utilized. The writer is forced, therefore, to give you his experience, trusting that in the discussion of his brief paper, new and valuable ideas will be brought out, which will prove of benefit to those unfortunates, who are often compelled to travel long distances while suffering intense agony from injuries.

It has been conclusively demonstrated that injured persons, except when suffering from severe and extensive injuries to the head, spine, thoracic and abdominal cavities or in a state of profound shock, may, when properly handled, be transported almost an indefinite distance without endangering life or in-

creasing the extent of injury. And it has been further shown by actual experience that a large percentage of the exceptional injuries above mentioned can be safely handled if proper transportation facilities are provided. In cases of lighter forms of injury, as a crushed limb, how should they be transported to the hospital in order that shock may not be induced or increased, or the already mangled parts be further injured?

The nearest surgeon is sent for, and under no circumstances should the patient be carried to him. The messenger informs the surgeon as nearly as possible of the nature and extent of the injury, so that he may come prepared, for not all surgeons have emergency cases, ready for every kind of accident. The surgeon, upon his arrival, controls hemorrhage, anticipates or combats existing shock, and adjusts a temporary dressing. Briefly, he prepares the patient for his journey, whether it be long or short. After due preparation, the patient is lifted gently a few inches from the ground or floor, and a stretcher slipped under him, and he is lowered into it and made comfortable. He is then carried into a coach or baggage car of the first passenger train going in the desired direction. An injured man should never be transported by a freight train. If no passenger train is available in a reasonable time, a "special" should be provided. If the surgeon in attendance fears for the safety of his patient, the chief surgeon should be notified of the fact, and he should instruct the surgeons along the line to visit the patient as the train passes their stations and render any assistance necessary.

As a rule, upon arrival at the hospital, you will find your patient in condition to submit to any operation required for his relief. The plan above outlined in this class of cases, is the one practiced on the system which the writer represents and furnishes the patient almost constant attention from the receipt of injury until he arrives at the hospital; the greatest distance

Internal view of Plant System Hospital Car "H."

between surgeons being forty miles, and usually but twenty.

The comfort and safety of the patient will depend very much upon the stretcher used in transportating him. The writer spent several years experimenting before one was secured which answered the purpose

to the satisfaction of himself and patients. Photographs of the ones that have been in use upon our system for the past eight years are submitted for your inspection. It is made of cypress; a light, springy, yet strong, native wood. The stretcher will pass easily through a car door, and two standard car cushions placed end to end, fit it exactly, and can be used as additional protection when required. The bottom of the stretcher is of wire netting, two-inch mesh, and is covered with eight-ounce duck. The netting and duck are fastened to the frame with strips of wood which are screwed on, enabling us to easily clean or repair the wire and duck. The legs fold under, and have heavy, corrugated rubber tips. This stretcher is light, strong, durable, and easily kept clean. It has sufficient elasticity to prevent undue jolting, but not enough to give pain. The writer has personally tested it, and can certify to its comfort.

What shall be done with those cases of extensive injury, accompanied by profound shock?

When the surgeon is given sufficient authority, these cases may receive the proper "first aid to the injured" at almost any point on the line of road, for all employes should be instructed that in case of accident, the surgeon's authority is practically unlimited, and that they must obey all orders given by him. By having the coöperation of employes generally, the surgeon is enabled to isolate his patient and give him perfect quiet and rest.

The patient should be allowed to remain at the place where the accident has occurred until the arrival of the ambulance or relief car, in which he is

placed and transported to the hospital, either by a "special" or by the first passenger train, as may be considered best.

There have been several plans of ambulance cars proposed from time to time, but they have, in the writer's opinion, been too elaborate, entailing a large expense upon the company, the officials of which could not see a proportionate benefit; and in my judgment they have taken the correct view of the case. What we need is a strong, stiff car with first-

External view of Plant System Hospital Car "H."

class trucks, furnished in the simplest style, without upholstery of any kind. We need a transportation room, an operating room, and a small consultation room.

A photograph of car "H" of the Plant System is handed you for inspection. This car was a second-hand express, remodeled and refitted according to the writer's suggestions. The total value of the car, as completed, is about three thousand dollars.

The doors in each end are hung on the wrong side, so to speak, so that in opening they act as a screen, preventing undue draft upon the occupant of the car; this was done at the suggestion of President Plant.

Now, as to furnishings. The transportation room is furnished with wrought iron beds, with woven wire springs. Heavy, corrugated rubber tips are on the legs, which prevents slipping, and breaks the jar to a great extent. When not in use, these beds are fastened against the walls of the car, and are entirely out of the way. In addition to these, we have an air bed, which when not in use, is folded into a very small compass, and packed into a closet. It takes but a moment to inflate it with air. Lastly, there is a hammock arrangement made to suspend from the roof of the car by strong straps. This hammock has a device of short, strong spiral springs, which absolutely prevents any jolt or jar being communicated to the patient.

The operating room is supplied with an iron, glass-top table, and all necessary appliances for the treatment of shock, and for the performance of perfectly aseptic operations. Sterilizers, etc., are stored beneath the water tank, which is kept filled with sterilized water. All bedding, etc., are packed in the corner cupboard. Bandages, bottles containing chloroform, ether, etc., are in the center cupboard. The rest of the furnishings may be seen in the photographs.

The sitting room is intended only for a place of consultation.

The car is painted with a specially prepared paint, which may be scalded without injury, and will stand

disinfection by means of super-heated steam or air.

There should be a relief car of some design for every two hundred miles of road, the car being stationed in the center, having a one-hundred mile run each way.

Gentlemen, it is my opinion that there are few cases of injury that would not bear transportation if handled as outlined above. If you have cases that you are satisfied will not stand transportation even in the car, you have at your command comfortable quarters for them, and if necessary, you are prepared to perform any operation that may be needed, and remove them to the hospital at a subsequent time.

A WORD ON THE MODERN USE OF THE TERMS INFECTION AND CONTAGION.

BY R. HARVEY REED, M.D.
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COLUMBUS, O.

With the advance of the germ theory and its practical application to disease, no small amount of confusion has arisen in our text-books in the use of the word infection.

Dunglison's dictionary, published in 1860, defines the word infection as synonymous with contagion and defines contagion as being the transmission of a disease from one person to another by direct or indirect contact. It also states that the term has been applied by some to the action of miasmata arising from dead animal or vegetable matter, bogs, fens, etc. It says that contagious diseases are produced either by a virus capable of causing them by inoculation, as smallpox, cowpox, hydrophobia or syphilis, or by miasmata proceeding from a sick individual, as in plague, typhus gravior, measles, scarlatina, scrofula, phthisis pulmonalis, or cancer.

By these definitions, you will readily see that the same term is applied to widely different conditions and we are almost justified in saying diametrically different causes.

Thomas, in the edition of his dictionary for 1886, defines infection as being "the communication of a

disease by personal contact with the sick or by means of effluvia (whatever that may be) arising from the bodies of the sick; contagion; the transmission of disease from one individual to another of the same species, or from one animal to another of a different class." He concludes his definition by saying the term is sometimes used as synonymous with contagion or agent by which a communicable disease is conveyed.

In the same dictionary he defines contagion as "the communication of a disease by contact or by inhaling the effluvia from one already effected—often used as synonymous with infection." Here, again, we have diametrically different conditions defined as synonymous terms.

Keating, in his edition of 1892, says that infection is the contamination with a poison or virus which has the power of invading and multiplying in living tissues. Communication of disease; contagion; atmospheric contamination. He also defines contagion as being the process by which specific diseases are communicated from person to person. Specific disease may be communicated by contact or by near proximity of the sick to the well, when the process is termed direct contagion. He concludes by saying that if communicated indirectly, by means of clothing, food, etc., infection is the more correct term.

In the 1893 edition of Dunglison's dictionary, we find infection defined as material essential to, and concerned in, the propagation and spread of communicable diseases. The process by which disease is communicated to an individual by diseased germs from the external atmosphere. In the same edition

the definition of contagion varies little from that given in the edition published more than a third of a century ago.

Prof. Pepper, in his work on diseases of children published in 1874, defines scarlet fever as being an epidemic and contagious eruptive fever; and yet we all know that scarlet fever will be communicated from one person to another without the necessity of direct contagion or personal contact. In the same work he states that syphilis may be contracted by direct contagion. Here we have the same definition given in two diseases. The one, syphilis, we know is never contracted except by direct contact, and the other is a disease which is seldom contracted by direct contact, but the germ of which is carried in the air, and if carried in the clothing must be inoculated and thereby the disease introduced into the circulation.

Roberts, in his Practice, published in 1874, defines measles as a distinctly infectious disease; which, according to the definition given to infection by our dictionaries, would mean that it is absolutely necessary to have a healthy person come in direct contact with another afflicted with measles in order to contract the disease, and I am sure there is not a practitioner here this afternoon who will admit that that is necessary. Coming down to our more modern authors, Whittaker, of Cincinnati, defines chicken-pox, in the American Text-Book of Theory and Practice of Medicine, published in 1893, as an acute infection of children. Now, what are we to understand by this? If infection means contagion, and contagion means contact, are we to understand that chicken-pox is transmitted from one person to another only by actual

contact? If the definition is intended to mean this, certainly clinical experience proves the contrary, and it can be readily demonstrated that actual contact is not necessary to convey chicken-pox from one person to another. In the same volume, the same author defines smallpox as being a highly contagious disease; and yet, we know that smallpox will be conveyed from one person to another in exactly the same manner as chicken-pox is conveyed from one child to another; yet in the one instance it is called infection and in the other instance contagion. In the same volume, Thompson defines syphilis as a chronic infectious disease; but who is there to-day who will not admit that acute syphilis is only contracted by direct contact? Again, Bartholow, in his Practice, published in 1880, defines hydrophobia as a specific disease due to the inoculation of a poison. If this be true, why should not the same definition be applied to syphilis, when we all know that it is produced by the inoculation of a specific poison?

We might multiply these quotations indefinitely. Our text-books and dictionaries are filled with contradictory definitions of the same conditions, and is it any wonder our students come to us to define what we mean when we refer to infection, and what somebody else means when he speaks of contagion? By these few quotations from accepted authors it is evident that the same terms are used in medicine for entirely different conditions, and applied to diseases which are contracted under, we might say, almost diametrically different circumstances. Owing to this Babylonic confusion of terms, sanitarians in making laws to cover the sanitary condition of States and

municipalities, have included both infection and contagion without endeavoring to define what is meant by either, so that the transgressor can not escape on a technical definition of terms. It seems to me, however, that the day has come when a more distinct and definite nomenclature should be applied, and terms should be used which have a definite meaning and which indicate certain definite conditions. Especially is this true in surgery, where accuracy of language is so essential in conveying a proper idea of the meaning intended by the writer.

The generally accepted term "infection," as applied in surgery, means the introduction into the human economy of some microörganism by inoculation or direct contact. Clinical experience, as well as experimental research, have long since taught us that the infection of a wound by pus microbes means the development in that wound of pus; and if that means anything it means that a specific microbe has been introduced into the wound, and there has found a suitable culture medium for multiplication. We do not as surgeons expect a patient to become infected with pus microbes by reason of the presence of another patient in a distant part of the ward suffering from pyemia, so long as proper care is taken to avoid the conveying, by actual contact, of these microbes. But does that hold good in cases of measles, smallpox, scarlet fever or whooping cough? Certainly not. The presence of a case of any of these in a ward, without actual contact, is liable to produce an epidemic, not from direct contact but from what our old authors called "infection of the air," which is an entirely different method of carrying these diseases

from that by which pus microbes are conveyed from one person to another, but which is called infection.

Having briefly reviewed the confusion in the use of the words infection and contagion in medical literature, let us turn for a moment to surgical literature and observe the conditions under which these terms are used in it.

Senn, in his "Principles of Surgery," in speaking of tetanus says that the infectious nature of the disease was well known and established before the discovery of the bacillus tetani. In speaking of the etiology of this disease, he says further that the bacteriology of tetanus is the essential cause of the disease; the remaining causes are accidents, the condition which results in the formation of an infection atrium. In speaking of this infection atrium he says that it is a well-known clinical fact that punctured, lacerated and gun-shot wounds of the hands and feet are most liable to be followed by tetanus. Again, the same author, in the same work, in speaking of pyemia, says that it is a general disease caused by the entrance into the circulation of pus or some of its component parts. In referring to the bacteriologic experiments of Klebs, he says that in his experimental research during the Franco-Prussian war he found this microbe invariably present, notably at the primary seat of infection. In speaking of the etiology of this disease, he says that the location and anatomic structure of the tissue in which the primary infection has taken place exert an important influence in the production of the disease. From these and many other statements by the same author, it is clearly shown that the word infection is used to indicate the introduction into the economy

through some form of wound, or some form of bacterial or chemic poisoning, as the case may be. If this be true, then how are we going to harmonize the use of the same word to imply the carrying of a disease in the air and its introduction into the human economy, without a wound of some kind, as is the well-known fact in measles, scarlet fever and diseases of that class?

In "Tilman's Principles of Surgery and Surgical Pathology," by Rogers, Published in 1894, we find the author speaking of the existence of infectious diseases of wounds, and he says that these infectious wound diseases are all caused by bacteria, and gives as examples anthrax, hydrophobia, glanders, etc., which are diseases communicated from animals to man. Actinomycosis, tuberculosis and syphilis, he says, are also due to infection by microörganisms. He further states that bacilli are capable of gaining access to the tissues or fluids through any wound, even the smallest interruption in the continuity of the skin or mucous membrane.

Warren, somewhat in contradistinction to other modern authors, refers to contagion and uses it as identical with infection. In referring to erysipelas, he says it is one of the most frequent of traumatic infective diseases, and further on states that the most frequent point of entrance of the virus is through a wound. In speaking of erysipelas, he says that the occurrence of several cases of the disease in a certain locality, or in a hospital ward, is not necessarily evidence of its contagiousness, for such a concurrence of events may be due to a common cause from which each case has taken its origin. Again, he says:

"There are, however, undoubtedly cases which are contagious in the highest degree." The same author in the same work, in speaking of hydrophobia, asserts that it is a disease caused by inoculation, and speaks also of the propagation of syphilis by inoculation. Tetanus, he says is an infectious disease, and yet, it has been clearly demonstrated that tetanus can be produced by inoculation just as well as hydrophobia.

In the "American Text-book of Surgery," published in 1892, the author divides this subject into three principal divisions, and speaks of mixed infection, which, he says, includes all the ordinary septic wounds and likewise those special wounds which are, at times, accompanied with marked tendency to spread inflammation and gangrene; second, the chemic poisons, the result of bites of insects and reptiles; third, microbic infection, such as rabies, glanders, etc.

From these few quotations it will be observed that authors differ very much as to the use of these terms and their application to certain conditions. It is the varied use of these terms and the ambiguous meaning attached to them, that are daily causing confusion among students of both medicine and surgery. It seems to me there should be a revision of our nomenclature and that proper terms should be employed to convey definite meaning. For example, some authors refer to primary infection as being the primary point at which some microbe has entered the economy, and secondary infection as meaning the second atrium occurring in the same person, instead of using multiple infection to show that there are multiple atria of the same germs. For example, in pyemia we have the absorption of pus from a primary point of infec-

tion, and we have a dozen or more atria of pus microbes forming as many different abscesses throughout the economy. This is strictly multiple infection and not primary, secondary or tertiary, which is an entirely different thing. Primary infection occurs where there is an introduction of a certain microbe, such as pus, and secondary infection occurs where there is the addition of another microörganism, for example tubercular bacilli, producing mixed infection; yet we find authors using these terms synonymously, and thus confusing students as to the real meaning to be conveyed.

The complicated nomenclature in reference to infection, contagion and inoculation has long since impressed the author with the importance of having a clear and more specific use of the terms than we have at present. Since I commenced to prepare this paper, and after giving the matter more systematized thought, I am astonished at the irregular use of the same terms in our various text-books. While I feel that I have given the matter but incomplete investigation, yet I am fully convinced that it is high time something should be done to bring order out of chaos. At present we do not feel justified in recommending to the medical profession what particular terms should be used in this connection, but we would recommend that a nomenclature be adopted and terms used that will be definite and which will enable a writer to state clearly what he wishes to convey and will enable the reader to understand without question what is meant.

In closing this paper I would suggest that the Academy appoint a committee of three to consider this question and that a request be sent to the proper

officers of the AMERICAN MEDICAL ASSOCIATION and the American Surgical Association to appoint a committee of three from each of their bodies with instructions to form a joint committee from the three associations whose duty it shall be to consider this question and recommend a nomenclature that will be more exact and modern.

It was moved by DR. REED and seconded by DR. L. E. LEMEN, Division Surgeon U. P. R'y, Denver, Colo., that those present who are not Fellows of the Academy be invited to participate in the discussions of the papers. Carried.

DISCUSSION.

DR. H. J. MAYNARD, of Wyoming—I think there is no discussion possible in this case, because I agree with the Doctor that there is great confusion that ought not to be allowed to exist. There has been for years a mixing of terms. You write one word and you are understood, perhaps, to mean another; you write the other and you are understood to mean the first. I think attention should be called to the matter by the different medical societies of the country, so that order may be brought out of chaos in the literature of the profession for the years to come. The suggestion is a good one and well taken, and I do not see how we can discuss it; we certainly can not quarrel with it, and can not object to it.

DR. L. E. LEMEN, of Denver—I am a great deal like my friend from Wyoming; I simply rise to compliment and agree with Dr. Reed in his paper and second his suggestion for a committee of three to be appointed. I know whenever I use one term and mail my communication I am very sorry I did use the other term.

DR. WM. THOMSON, of Philadelphia—The literal meaning of the word contagion is "to come in contact," and I think if we would adhere more strictly to the literal meaning of those two words, not that I can give you a literal explanation of the meaning now, though I have looked it up several times, it would be of great assistance to us. If a disease we have contracted by coming into actual contact with the wound, like syphilis, would be classed as contagious, and the other as infec-

tious, I think it would help us out materially. The literal meaning of the word contagious is, "coming in contact," and I think everybody will understand, if you come in actual contact with the sore, as you do in syphilis, it would be a contagious disease.

DR. C. B. KIBLER, of Corry, Pa.—It seems to me as if the suggestion offered by the author of the paper is a very wise one and should be considered; that is, that a committee of three be appointed to confer with the other societies on this question. I therefore make such a motion.

DR. E. GRISWOLD, of Sharon, Pa.—The paper seems to deal with facts and the statements the doctor makes are, I consider, facts, and there ought to be a differentiation between the meaning of infection and contagion. Now, I have differentiated in my own mind, but I have never seen it done in the literature of the profession, or in text-books; and I believe it is important that the word "infection" and the word "contagion" should be defined strictly as can be done by the suggestions made by Dr. Reed. I think it would be a very fine thing, and no doubt be a great benefit to students. I presume Dr. Reed is finding trouble from that source. Students get confused and naturally enough do not know what distinction to make between infection and contagion. I think we had better carry out Dr. Reed's suggestion, which I think is a very good one.

The motion made by Dr. Kibler was seconded by Dr. Maynard, that in conformity with the suggestion made by the author of the paper, a committee of three be appointed to confer with the American Surgical Association and the AMERICAN MEDICAL ASSOCIATION, to confer with like committees from those bodies to take up the subject of the matter suggested in the paper.

DR. REED—I would suggest an amendment to that, that in addition to having a committee appointed here the Secretary be instructed to request those bodies to appoint similar committees to confer with this committee relative to this matter, setting forth the reason for such a committee.

DR. KIBLER—In order to make this thing quite clear, I would like to amend that motion a little, that Dr. Reed, our President and the Secretary be that committee if Dr. Maynard will agree.

DR. MAYNARD—I accept.

The resolution was then reduced to writing as follows:

Inasmuch as there is much confusion as to the proper use of the terms infection and contagion, be it

Resolved, that a committee consisting of Dr. Reed, the President and Secretary of this Academy, be appointed to confer with a like committee from the Americal Surgical Association and the AMERICAN MEDICAL ASSOCIATION, with the idea of coining a new word that will meet with the approval of the profession.

DR. WM. T. DALBY, of Salt Lake City, Utah—The question of infection and contagion is a question that was brought up and discussed in its entirety by Dr. Hammond, of New York, some ten years ago, and seems to be a very difficult one to handle. Some diseases seem to have both the condition of infection and contagion. After a lengthy essay on this topic he came to the conclusion which we are at the present time, that is a condition of confusion. The question as I understand the resolution is, that a committee be appointed consisting of three Fellows, to confer with like committees of the AMERICAN MEDICAL ASSOCIATION and the American Surgical Society that would represent the three associations. I believe it would be almost impossible to get these nine men together. I think it would be a better idea if this Association, the Academy of Railway Surgeons, would themselves make some effort to define, if there can be a definition at all, between these two terms. If we expect to have a conference with a committee of these other two associations, I am afraid when we meet again a year hence we will be in the same condition as we are now.

DR. REED—Before submitting this proposition, in the paper, I have taken the pains to consult with quite a number of the prominent members of the profession throughout the country relative to this matter, and I have been unable to find any one member who felt that he was able to offer a substitute for the terms used that would be satisfactory from a surgical standpoint; at the same time, every member of the medical profession that I have consulted agreed that the terms were exceedingly confusing. Now if a term is decided upon, if some particular name is suggested, it would be well, it seems to me, to have the indorsement, not only of the American Academy of Railway Surgeons, which you all know is a child, so to speak,

in the arena of American medical and surgical associations, but also the indorsement of the American Surgical Association and the AMERICAN MEDICAL ASSOCIATION. I agree with the gentleman who spoke last, that it would probably be somewhat difficult to get a committee together on the subject, but it is highly important that we should get them together. If we adopt a term, with a membership of one hundred, and start out to use this term, we may find some difficulty in getting this term adopted and we will still remain in confusion. My idea is to have it adopted by the leading associations and especially the AMERICAN MEDICAL ASSOCIATION, that this term may go out and be used by these members, and very soon the terms that are now in use will become obsolete, practically, and the new term as adopted will be taken up. The questions that we are considering now more particularly are those from a surgical standpoint and it is certainly exceedingly confusing to use these old terms. Ten years ago the matter from a medical standpoint was scarcely considered, and it is only since the question of aseptic and antiseptic surgery has become prominent that the term infection has come into use. Unfortunately, it seems to me, we have accustomed ourselves to the habit of saying that a wound is infected, when in fact we mean that something has come in contact with that wound and is introduced into it either a specific poison or a microbe of some character. For us to say that a wound is contagious would sound quite bad, hence we have as a consequence dropped on the word infection, and we say that a wound has become infected when we do not mean to use the word as interpreted by our dictionary. We have used the word abstractly, and for that reason I think it necessary as has been suggested by prominent men, to coin a new word. It has been suggested that we get some parties on this committee from one of the associations who are Latin and Greek scholars; they might be able to coin a suitable word that will express our views on this point more accurately. I concede that while there is a great deal of confusion in this matter there is going to be no small amount of trouble to get a word that will be convenient and will mean just what we want it to mean when we desire to describe the introduction of foreign germs into wounds in surgical practice.

DR. A. D. BEVAN, of Chicago—I am opposed to the resolu-

tion. I do not believe that it comes within our field of action. Work of this kind, if it is done by medical men at all, should be done by pathological and bacteriological societies, societies which have a wider scope of action than the Academy of Railway Surgeons. We might as well devote all our time to taking up the many points in contest in the nomenclature of any other line of medical work, and I do not believe that it is wise for us to take up a subject of this kind; I do not think that it would be any great credit to this Association to attempt work in this line. I should like to see the resolution voted down. Work of this kind certainly belongs to lexicographers and biologists and not to railways surgeons, and I believe we should limit our work here to railway surgeons.

DR. REED--I fully appreciate the force of Dr. Bevan's argument, yet at the same time I do not think that the Doctor probably comprehends the difficulty in the suggestion that he makes. Take our pathologists and very few of them are in active surgical practice, with now and then an exception. We who are using the term every day feel the necessity of having something that will give us a definite idea of what a writer is saying when he uses a certain word. I do not think it is right for us to continue to use the word infection when it does not mean what we intend it should. It is not scientific, it is not scholarly, and yet if we wait for the pathologists to come to the front, who care little perhaps as to the use of the word, because they are not using the word in the sense surgeons are, I think we will wait till the snows of Iceland cover Chicago. I think it would be perfectly right, when it comes to the appointment of a committee from the AMERICAN MEDICAL ASSOCIATION, that they should appoint pathologists on their committee, and it is perfectly in harmony with the resolution that the pathologists should take a hand in solving the question.

DR. MEYERS, of Meyersdale, Pa., spoke in favor of the resolution, which was then read and adopted.

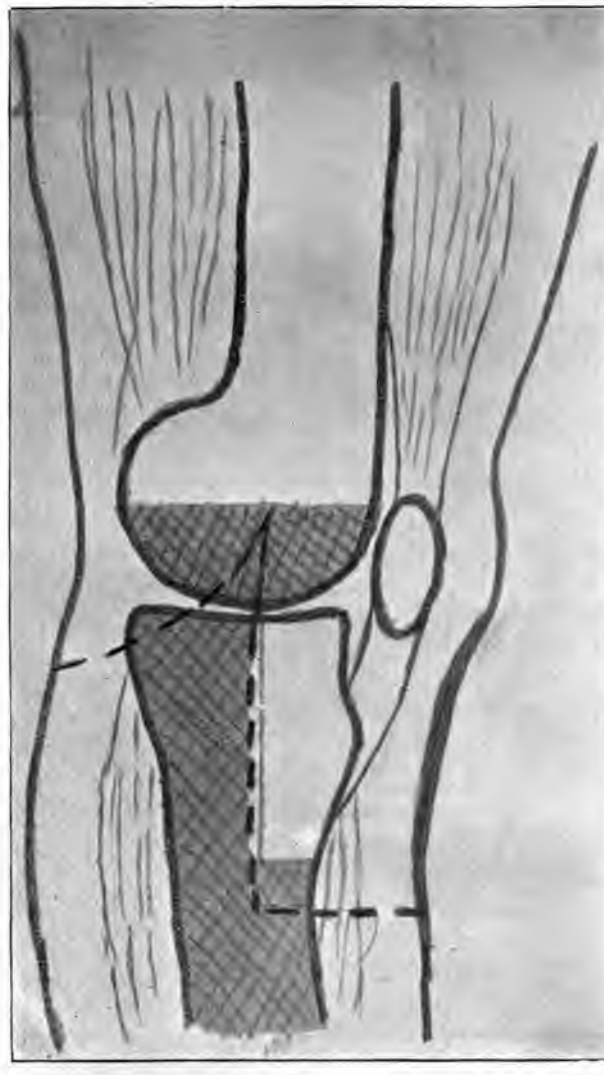
Chapter III.—Amputations.

AMPUTATION AT THE KNEE-JOINT

BY W. H. BUECHNER, M.D.
CLEVELAND, OHIO.

The first mention of the removal of the leg at the knee-joint dates back to 1581, when such an amputation was made by Fabricius Hildanus. The method then seems to have been lost until 1764, when it was again brought to light by Hoin and indorsed by Petit and Brasdor. It was not, however, until Velpeau popularized it in 1830 that it began to approach the place which it now holds in the domain of surgery The first American operation by this method was that of Dr. Nathan Smith in 1824.

Considerable difference may be found in the nomenclature of this subject. Disarticulation at the knee is called both by that name and by that of amputation; while to designate amputation through the femur, the names condylar, transcondylar and intracondylar amputation are employed. Ashhurst, in his International Encyclopedia of Surgery, says: "By amputation at the knee-joint is meant a pure disarticulation; in amputation at the knee, a larger or smaller portion of the femoral condyles is also removed." This is a move in the right direction of simplification which might well be generally employed. In this paper,

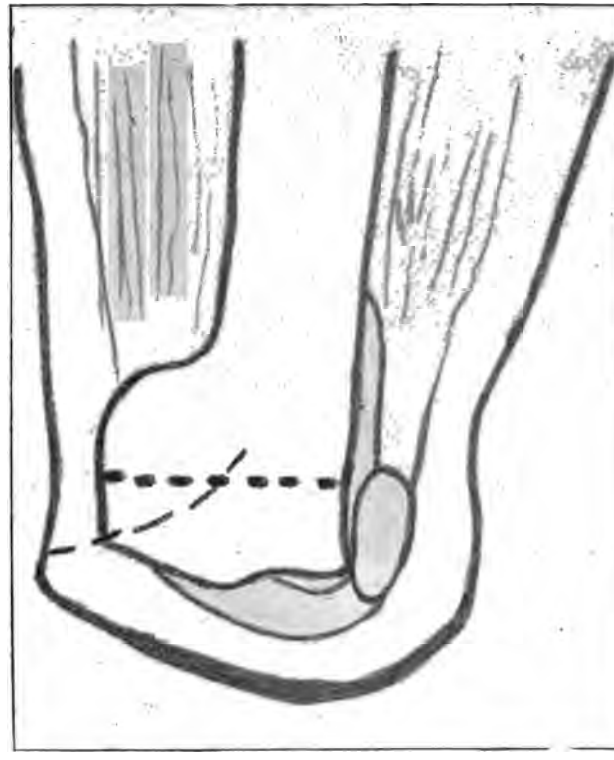


however, it will answer every purpose to use the terms synonymously.

I am unable to find any statistics bearing upon the mortality of this operation since the introduction of antisepsis, and those of the pre-antiseptic era are of little value to us now. The pre-antiseptic statistics show a mortality about equal to that following amputation of the leg and much smaller than that of the thigh. In nineteen cases of disarticulation for disease done by Bryant between the years 1868 and 1883 but one death was directly due to the operation. (Med. Chir. Trans., Vol. lxix, 1886, p. 163.)

The advantages claimed for amputation at the knee are as follows: The medullary cavity is not opened and there is less shock; the attachment of the muscles is less interfered with, there is less retraction and therefore less liability of the formation of a conical stump; the muscles are not divided through the parts which are thick and vascular, but through their tendinous insertions; the stump is left longer than by a thigh amputation; the stump produced is capable of bearing the weight of the body upon its extremity. The last named is probably the most important ground upon which these operations base their claims for popularity. I am well aware that certain artificial limb makers deny the advantage of this and condemn all amputations at the knee because they can not fit satisfactory protheses to such stumps. They appear before the surgical world and demand that it make unnecessary sacrifice of length of limb to bring the patient within range of their mechanical ability. They ask us to whittle down our patients to fit their limbs instead of fashioning their limbs to suit the

patient. It is sad that selfishness can carry men to such extremes. If they can not fit limbs to such stumps it would be more becoming for them to abandon the business to those who can than to come to us



with the demand that we "cut our men to fit their cloth." I am not here for the purpose of advertising any special make of limbs, still I must quote from a maker who has had the experience of fitting prothetic

appliances to thousands of stumps. In a paper entitled "Amputations Prothetically Considered," and read before the Pan-American Medical Congress, Mr. George E. Marks says: "When a leg-maker of modern times says an amputation should not be made below the point of election, you may regard him as confessing that he has not the ability to make a leg which can be worn on a long stump. . . . . Any stump which is capable of bearing weight on the end is preferable to one which can not. . . . . A stump extending to the knee is preferable to a shorter stump. . . . . the condyles and articular surfaces are better prepared to endure pressure than the saw or the knife can prepare them." From the above it may be seen that all protheticians do not condemn knee stumps and ask us to fit our patients to their limbs. It would carry me too far if I should consider the various methods of amputation at the knee-joint, descriptions of all of which may be found in the text-books upon surgery, and all of which possess their advantages and disadvantages. I will therefore speak of a method which contains more of the former and less of the latter than any of the others, and one which I fail to find mentioned anywhere in the English language. I refer to the method originated and published by Sabanejeff, of Odessa. (Chirurgitschesky Wiestnik, 1890.)

The idea of this operation can be gathered best from the diagram I now show you. Beginning at the lower margin of one of the condyles of the femur at a point slightly posterior to its middle, an incision is carried vertically down the leg, then turning at a right angle it crosses the anterior surface of the leg

about three finger breadths below the tuberosity of the tibia, then turning again at a right angle it ascends the leg to a point upon the opposite condyle corresponding to its beginning. The free edges of the large rectangular flap formed by these incisions are dissected up only for a distance of about three-quarters of an inch. The upper extremities are then connected by a curved incision which crosses the popliteal space at the level of the lower border of the head of the fibula—thus forming a short posterior skin flap which is dissected loose up to its base. At the base of this flap an incision is carried down to the joint, dividing all the remaining tissues upon the posterior aspect of the limb. The joint is opened from behind and the ligaments divided, permitting the leg to be hyperextended until its anterior surface rests upon the anterior surface of the thigh. The leg is still attached to the thigh by the component parts of the anterior flap. The condyles are now divided through their middle in a direction at right angles to the long axis of the femur. The saw is then applied to the tibia at about the juncture of its anterior and middle thirds and that bone is divided parallel to its long axis for a distance equal to the antero-posterior diameter of the section of the condyles. At this point the section of the bone is completed by a few strokes of the saw applied to its anterior surface at right angles to its long axis. Before removing this plate of bone from the tibia it may be necessary to dissect up the loose edges of the anterior flap to a greater extent than has been done—how much, if any, will readily be seen at the time. When the flaps are brought into apposition the piece cut from the tibia adapts itself to the cut

surface of the condyles much as the os calcis does to the tibia and fibula in Pirogoff's amputation. It is easily maintained in position without nailing or wiring and readily becomes attached to the femur.

The stump formed by this operation is as round and pretty as a normal knee and bears the weight of the body without the slightest discomfort. The normal relations of the parts are less disturbed than by any other method, but its chief point of superiority to Gritti's and all other operations is that the weight is thrown upon a part which is accustomed to bear it and which is anatomically arranged for that purpose.

Anybody can readily satisfy himself that in kneeling the weight does not rest upen the skin covering the patella, but upon that covering the tuberosity of the tibia. Because of this, nature has covered the patella with a thin integument little able to withstand pressure, and the tuberosity of the tibia with a thick skin designed solely for that purpose. In this operation the parts about the tuberosity are not disturbed and so the stump bears pressure as well as the normal knee. In other methods the thin skin of other parts of the knee is expected to bear the weight of the body, and, as would be expected, soon becomes irritated and painful.

W. Koch reports (*Berliner Klin. Wochenschrift*, 1891, No. 25) five cases operated upon by this method at the clinic at Dorpat with invariably good results. I performed the operation—I believe for the first time in America—last February, and am delighted with it in every particular. I feel sure that if any of the gentlemen will try the method they will lay aside all others and become as enamored of it as I am.

DISCUSSION.

DR. DANIELS, of Buffalo, N. Y.—I have been very much interested indeed in this paper, as the method is certainly new to me. At the same time, looking over the illustrations the Doctor so plainly placed before us with his description, it seems to me that if we have as much tissue for a flap as is there shown with as much good bone as it also shows, we could make an amputation at the point of junction below the knee and not disturb the joint at all. The illustration would rather indicate that, and the method of placing the bone, I see, refers to the modification of Pirogoff, that is well known to us all. It is an operation I have performed quite a large number of times and in addition have gone down below the point of Pirogoff's modification and performed work as is shown here at the knee. I would like very much to have the Doctor detail the case he operated, explaining the conditions that necessitated the amputation and giving us a little information on the point of the extent of laceration and obtaining the amount of tissue necessary to the operation.

DR. LEMEN—While he is explaining, I would like to have him explain what he does with the fibula.

DR. JAY—Before you establish a rule in surgery of any kind, and particularly the destruction or amputation or even disarticulation at joints, it is necessary to have more than one case to prove anything. I never made that amputation but have been compelled to make them over the knee-joint, or to cut above the knee-joint, but I never have been favorable to a disarticulation at the joint. If I can save three inches of the tibia, below, so as to have anything like a natural joint at the knee, I do it. Then my experience, too, has been that I would rather go above the joint than to go directly through it. I fail to see any great advantage in the operation. It is plain to see that it is very unique and very nicely done, and looks well on paper. But if there is any danger of the patella suppurating or sloughing off, I should want a great many cases, more than one certainly, to satisfy me. It might take place, as it does in Pirogoff's amputation, but a large number of surgeons do not make Pirogoff's for the simple fact that in the registry of twenty-one cases in this city, every one is a failure. A great many occurred at the County

Hospital, and there were twenty-two failures out of 109 where the suppuration and sloughing of part of the astragalus, which was turned up against the end of the tibia, took place. They were not successful. I do not see, however, where the advantage would arise even if this osseous portion of the tibia were brought crosswise over the sawn off condyles of the femur and connected so as to make a stump on which the weight of the body was to rest. Of course the old way would be to denude or remove the articulating surface between the condyles of the femur and also the patella, and bring the patella in contact with the end of the femur. It seems to me on the very same principle, except that the skin covering to the patella would not be quite so thick as that of the tibia. I do not want to find fault with the operation, as I never saw it in my life. I have seen some record of cases that have been performed, but not a sufficient number of times to make me adopt it. I would want more than the evidence of one amputation.

DR. MAYNARD—It is shrewd, it is mechanical, it is creditable, but running back in my mind, away back yonder when Dr. Lemen was a baby, I can not remember a case where I could have made that operation without having better made another one. The Doctor says he is satisfied entirely with his results. I would ask for my personal information a detail of the case, of the condition of the injury, what led up to it and what gave him the opportunity to save so much of the tibia.

DR. GRISWOLD It does not occur to me that the danger of absorption through the condyles is so conspicuous as our friend seems to think. I have done a great many operations myself, in cases of tuberculosis of the bone, where I would saw off a piece of the condyles and find that the condyloid tissue was not sound. If two-thirds or three-fourths of the tissue was sound, I would curette out two or three spots and cut all the diseased tissue out of the cut surface, leave the rest and have a good result. In a case of cancer some eight or nine years ago where the woman was nearly dead, seemingly from general cachexia, very pale and very thin, suffering greatly from cancerous disease of the tibia, involving the ankle up to the knee-joint, I amputated it at the knee-joint and found that the condyles were diseased. I cut off a portion and found there

was some evidence of discoloration. I cut off a little more and curetted two or three spots out and got a good result, and the woman is living yet. This was as much as eight years ago, and she is still in good health, so that I do not think the concellous structure of the condyles absorbs so readily and carries poison through the system so readily as it is carried by the lymphatics.

This operation, which is new to us, seems to me to deserve a trial, for it might happen and does happen as I have seen once or twice myself, where the muscles of the calf were torn off from the part, that an amputation could not have been performed below the knee-joint, and must be made either through the joint or above. When such is the case, if there is not enough tissue to make neither the posterior nor anterior flap below the knee, it is possible that such an operation as the one under discussion may be warranted. It strikes me it ought to be considered, and if a suitable case offers should be tried.

Dr. Gardner, of California—It seems to me that the object of amputations is to save the patient's life, and in railroad surgery the second object is if the stump is practical to allow an artificial limb. In this case that has been presented here so nicely I fail to see whether the piece of bone there placed in position would give a better stump than an ordinary amputation. All stumps after a while become more or less absorbed, not only the bony structures but also the muscle, and there is no doubt but that this stump also would become absorbed to a certain extent after awhile. I do not think if I had to perform an operation at any time, I would make the amputation after the old way.

Dr. Owens—I regret to say that I did not comprehend the first part of the paper and am not in position to say very much about it. What I have gleaned is not very favorable toward performing the operation. As has already been suggested, when railroad men have received an injury, and when the question is presented to them, whether they desire an amputation that will permit them to wear an artificial leg, or want a joint or foot that brings the joint at a lower level than the natural joint of the other side, they almost invariably, so far as I remember, select the operation which permits the wearing of an artificial limb. The operation is ingenious and the principles are already well known through the different operations on the extremities,

but the operation does not strike me very favorably. Of course it is new and has its beginning, but I will condemn the operation.

DR. PECK, of New York—It seems to me that this is a modification of the Italian operation, which is called the trans-condyloid operation with splitting up the patella and bringing the new middle surface up. It seems to me that this has nt particular advantages over the original operation, and has some marked disadvantages in this way: The trans-condyloid operation in which the patella is brought up to bear the weight contemplates removing or making a dissection through the condyles very near their junction with the shaft of the femur, making a smaller bone surface of only about the same size as the patella itself. It would therefore seem reasonable that a bone surface of that size would be much better adapted to the wearing of an artificial limb than one which is so much larger than the condyles in the transverse axes are than the shaft of the limb above. As far as the bearing of weight is concerned, practically, we all know that when one leg is flexed from the thigh and weight is put upon any joint, it is the patella and its skin cover that bears the weight rather than the tuberosity of the tibia.

DR. BUECHNER I will first speak more particularly of the case in which I did this amputation. It was a re-amputation, I did not do the preliminary one, which was at the junction of the upper and middle third. The joint was perfectly stiff and nobody wanted to try to fit an artificial limb. The patient wanted to get a stump on which he could get an artificial limb. As to what Dr. Daniels said regarding the length of this flap, perhaps it is a little out of proportion in my illustration. If a person comes to make the operation, he will find that the flap is not as long as recommended in other methods, particularly in the Carden operation, he will find the flap is not as long as the flap recommended there, and I agree with all you gentlemen that I never would think of amputating a knee-joint if it was possible to do an amputation below the knee.

Now, as far as the absorption of pus in the tissues of the condyles is concerned, the statement that it would be more apt to absorb pus than any other tissue is at variance with the authorities. I have looked up the subject of amputation not

a little. I read it up in the new works which are being published at the present time. They all give as one of the advantages of amputation at the knee-joint and of trans-condyloid amputation that they are less liable to absorption than the amputations which involve the medullary cavity.

Another statement has been made that the tibia is different in structure from that of the condyles. Now, this is not a very long space here (indicating on drawing), and my teaching was that the head of the tibia was composed of similar tissue to that of the condyles.

About the suppuration taking place and the comparison with the Pirogoff amputation, I can only say that when in this year 1895 a person speaks of 22 cases of suppuration in 109 Pirogoff amputations there must be something wrong. I do not believe that any operator will get suppuration in 22 out of 109 cases if he follows the methods of to-day.

The statement that nobody does the operation of sawing the patella and putting it on is, I am afraid, not quite borne out by the facts of the case. Dr. Koenig, Professor of Surgery at Göttingen, was very much opposed to that operation until his second last edition of his work. Then he came out and said that further investigation, and particularly the work of Trendelenberg, called to Leipsic to take Thiersch's place, and some of his associates had caused him to try the operation further, and he was very much pleased with it and wanted to recommend and indorse it.

The benefits which I claim for this operation over the Gritti operation and over the other operations are: First, as to sufficient strength to bear the weight. I believe if the Doctor will get down on his knees pretty often, that he will find that the skin covering the tuberosity of the tibia is what carries the pressure. I know that I it was not in church had occasion to kneel a great many times in the course of a few days, and I know where I got sore, and I know the skin over the tuberosity of the tibia is thicker and is the skin which carries the weight of the body. For this reason I claim that this operation has an advantage over the Gritti operation and over all which take the skin from the neighborhood of the patella to cover the stump. The other operation that would cover the end of the stump with the fixed skin exactly as the old Pirogoff operation,

was condemned because the people cut off the tibia and the fibula and the astragalus at right angles to one another, and had to turn the flap to an angle of 90 degrees and put the weight where it never was meant that weight should be borne.

As far as this bone becoming absorbed is concerned, all stumps become absorbed more or less. I do not believe there is any more likelihood of its becoming absorbed than there is in the astragalus in the case of the Pirogoff operation.

The question about the fibula is a very easy one to answer. I probably was not explicit enough in my description of the operation, otherwise it would not have been asked. I spoke of dividing all the structures and all ligaments so that the limb was only attached by the component parts of this anterior flap here and then turning it up. Now then, to get the saw applied at the junction of the anterior and middle third, a person will notice on himself, why he misses the head of the fibula, as the fibula remains on this part of the leg which drops away. It remains on the part of the leg which falls away and does not come into consideration at all.

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GALION, OHIO.

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THE USE OF COCAIN IN MINOR AMPUTATIONS.

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Appreciating that at this, the second meeting of the Academy of Railway Surgeons, many papers of highly scientific and scholarly character would be read, I have ventured to tender one that may be as a rest "between the acts," but of a strictly practical character, and based entirely upon personal experience. I offer this brief paper as a fragmentary contribution to the literature upon cocain as a local anesthetic.

The question and study of anesthetics is always germane to the subject of surgery, and as railway surgeons we are close observers of the action of chloroform, ether and the other essentials used by way of inhalation for the purpose of producing neurotic narcosis for the relief of pain in our operative work.

Safety is, or always should be, our first consideration. The loss of sensibility, known as anesthesia, may be general or local, being dependent upon the agent and method used to induce the same; and the scope of this paper deals entirely with that of a local character. If experience is of value, I believe it will lead many of our surgeons to entirely abandon the use of chloroform, ether, etc., in minor amputations.

I feel that there are many members of the Academy, as well as others, who may have greater experience

than myself, but from the meagre amount of literature upon the subject, they certainly have not given us the benefit of their experience. The text books mention the subject of cocain in minor surgical operations, but do not clearly define the technique in a way sufficiently practical to cause the surgeon to give the subject but a passing glance.

All do not have the benefit of hospitals, with trained assistants and conveniences and I hope this paper may especially benefit those surgeons who do much of their work out along the line where minor amputations are of frequent occurrence and the surgeon is without competent aid.

For the past eighteen months I have used muriate of cocain in very weak solution, *exclusively* in minor amputations and feel like shouting "eureka" at the conclusion of every operation, except, of course, that I am not entitled to use the personal pronoun.

For the benefit of those interested, I will briefly detail method of procedure, taking for instance a crushed finger.

If the stump is long enough, after putting it through the preparatory toilet of soap, water, ether etc., I tie a narrow wet bandage which is always at hand and acts as a firm cord, tightly around it close to the knuckle joint. Then with a clean hypodermic syringe and needle I inject about ten or fifteen minims of a 2 per cent. solution of cocain, freshly prepared with sterilized water, immediately behind the proposed incisions, introducing the needle as follows: First upon the dorsal aspect letting it enter about one-half inch to one side and expelling three of four drops of the solution. I then partially withdraw the needle and

gently turn to the opposite side expelling the same amount; then partially withdraw it again up to the median line and deposit an equal amount at the point of entrance immediately beneath the skin.

You will note that fully one-half of the finger stump has received the solution and with but one puncture of the skin. Turn the hand over and repeat this from the palmar surface and in six minutes go ahead and amputate the finger and your patient will be in blissful ignorance of the pain. After completion of the operation and before closing the flaps squeeze, or I might say "milk" out, the cocain solution from the tissues, which can be quickly and readily done. Remove the constricting bandage, see that all bleeding is controlled, close the flaps in the usual way, and you will have performed a painless operation and one entirely free from the danger of poisoning, for if properly done, in my judgment, there will not be to exceed $\frac{1}{3}$ of a grain of cocain absorbed, which amount we all know is absolutely harmless.

One-fourth of a grain for each finger I deem ample, and as I commenced with a 4 per cent. solution in the early part of my experience and am now using but a 2 per cent. I think the strength may be still further reduced, but recommend that a larger quantity of the solution be injected, practically "flushing" the tissues at and immediately above the point of operation.

For operations at the knuckle or immediately behind, I use the same method with the constriction, but find it necesary to work a little more rapidly on account of absorption of a portion of the sotution as the operation proceeds.

While I have especially referred to the hand in a

descriptive or explanatory way, operative work under cocain may, in my judgement, be liberally extended.

DISCUSSION.

DR. ELISHA GRISWOLD I would like to ask Dr. Daniels whether in his opinion, when injecting cocain as described in this paper, the anesthesia extends from the point of injection some considerable distance from the end of the finger: that is to say, suppose you make a flap half an inch from the end of the finger, at which point you inject the cocain, is that point anesthetized as a general rule? Furthermore, I will say, I have used cocain a good deal in small operations, not much in amputation of the fingers, but to a considerable extent in the excision of small tumors. In some cases I have used it as a matter of election because the patients desired it. One patient, an old lady, 81 years of age, had an epithelioma involving the bridge of the nose and extending slightly into the cheek. She had insufficiency of the aortic valves, so that she was not a good subject for anesthesia by the ordinary method. But she was quite willing that cocain should be tried, and in her case about three years ago I injected it at points about one-quarter of an inch apart all around the tumors as near as I could. I used a 4 or 5 per cent. solution. In removing the tumor I cut a branch of the nasal artery, but by compression and torsion I was enabled to stop the hemorrhage, although it was quite a time before it was completely arrested. An effort was made to cover the open surface of the wound as well as possible with skin, but I could not do so because there was not enough skin with which to do it. When I went to insert the sutures some little distance beyond the point at which the cocain was injected, the patient felt the needle somewhat but not severely, and I find this to be the case with the removal of other tumors. In the case of a fatty tumor on the back I found, after removing the tumor and getting ready to insert my sutures, that the patient felt the needle, although she had not felt the knife in the removal of the growth. And so I would like to know if Dr. Daniels in his experience in amputating fingers with cocain, can tell us whether the anesthesia extends from the point of the finger so as to give plenty of room to operate, and so that the patient will not feel pain in making the flap.

DR. HENRY W. COE—Any one who has used cocain to any great extent in surgical practice, especially in very strong solutions, must have seen some very sick patients, for he does not know beforehand exactly how his patients are going to react. I consider cocain a dangerous analgesic, as ordinarily used. I think it is dangerous where a patient has serious heart trouble, and that in such case chloroform would be preferable. I know, of course, that the matter of personal equation comes in here. I know I would much prefer to use chloroform. I remember a case in which I began to operate for hemorrhoids, in which some authors would have said that cocain should always be used, and I am sure will never use it again. My patient came so near dying that I was frightened half to death myself. The method the doctor advocates, however, consists largely in complete saturation of the tissues. He uses a 2 per cent. solution. I have used even a weaker solution than that and a considerable amount of it with which to saturate the tissues. If we use a weak solution we need to operate rapidly because of the fact that the fluid will pass out through the wound, which is a point the doctor did not bring out in his paper.

DR. WEBB J. KELLY—Dr. Coe speaks in the discussion of the use of cocain during an operation for hemorrhoids. I do not know what the experience of other members of the Academy has been, but it has been mine when any operation has to be performed for hemorrhoids or other conditions in this locality, that chloroform or any anesthetic is likely to act badly; and I think probably that this fact is one reason why he has had so much trouble with cocain in operating on the rectum. I have had experience with cocain personally, inasmuch as Dr. Straight, last winter, sawed out a large piece of bone from my nose, using a 20 per cent. solution. They walked me around for three or four hours in order to keep me from dying, consequently I know what it is. Personally, I do not like to use it.

DR. L. E. LEMEN—I do not feel that I can go home satisfied without contributing a little to this paper in the way of discussion. For some time I have performed all amputations of the fingers very much in the manner that the essayist has described, more particularly in those cases that come to the physician's office where it is quite inconvenient to use a general anesthetic.

If a general anesthetic were used in one's private office, he would have to wait until the patient recovered from the influence of the anesthetic, and send for a janitor to clean up the mess afterward. I have used a 4 per cent. cocain solution for several years in amputating fingers, the amount being governed by the number of drops I would put in. I wait for fifteen minutes instead of six, after using the injection before I begin my operation, and have my attendants watching to see whether the patient flinches or not. The anesthesia lasts from five to eight minutes, which gives the surgeon the ordinary length of time to perform the operation and insert sutures. Instead of using gauze I use rubber bands. I take a rubber band, drop it in the solution, if I use antiseptics (I keep sterilized water in my office for this purpose), keep it in the solution for a little while prior to giving the injection of cocain, and then I put the band around the finger so as to localize the anesthesia. This controls hemorrhage completely. I have had no trouble from the use of cocain in this way, and I have amputated as many as two and three fingers at a time. I would amputate one finger, then I would inject the second finger, operate, sew up the flaps, disposing of one finger after another. There is only one objection to cocain, and that is its tendency to produce more or less edema in the neighborhood of the tissues that have been injected with the solution. I believe any solution, even pure or salt water would produce the same effect. While it may not come under the head of railroad surgery altogether, I will say that in children it is not well to use it because they struggle against your efforts. In adults I use it for the purpose of circumcision, and use a rubber band to control the hemorrhage as well as to localize the anesthesia. We will find subjects occasionally on whom, owing to their nervous temperament, no matter how slight the operation may be, cocain has a depressing effect. I have seen people faint from ordinary vaccination, even before I put the lancet to their arms. It is the mental effect, the very thought of being operated upon. In these subjects, where the nervous temperament exists to any great extent, I believe it would be better to use an ordinary anesthetic on account of the depression which may continue for some time; in other words, there is more shock than we ought to have from a simple surgical operation. In people of a nervous

temperament I would advise a general anesthetic where it is not contraindicated.

Dr. F. J. Hodges—I believe if the gentlemen using cocain will experiment with it a little, they will use much weaker solutions than have been mentioned here and still get good results. A great many men use a solution which would probably be not more than one-half of 1 per cent. of cocain, containing common salt, and a very small proportion of carbolic acid and a moderate amount of morphin. Their pilosophy of this procedure is this, that after all it is the pressure of the fluid within the tissues which is the active factor in producing anesthesia. There are a number of physicians in my part of the country who use regularly this solution in the strength I have indicated and do perfectly painless minor operations.

Dr. John E. Owens—The last speaker mentioned the fact that he thought perhaps even weaker solutions would be useful. Some gentleman wrote an able article upon this matter in one of our Chicago medical journals, in which he recommends the use of weak solutions, and said that almost infinitesimal doses were followed by gratifying results. I suppose it would be in order to mention another local anesthetic, although the paper is on cocain. I would like to call the attention of the gentlemen present to ethyl chlorid, which surpasses anything I have used up to date. It is a fluid contained in a glass reservoir and costs a dollar. It is kept from spilling by means of a cap at the conical end. It is an excellent local anesthetic for the removal of small growths. I have removed a small growth of the breast with it and also amputated a little finger. I believe it is a good substitute for cocain.

Dr. Daniels (closing the discussion)—Replying to the inquiry of Dr. Griswold, I will state that I have always found that I could operate from the knuckle to the distal point of the finger, in injecting between the knuckle and middle joint, without any pain whatever. But it is my practice always to inject the cocain immediately behind the point where I am to operate, and not to inject near the knuckle, but as far down as the operation is to be performed, consequently I am sure of anesthetizing the point desired.

As far as mentioning the use of cocain for the purpose of removing larger growths is concerned, I will say that my paper

dealt entirely with its use in minor amputations. I have also used it in removing small tumors as described by other gentlemen.

Dr. Hodges' remark in regard to weak solutions is only an echo of the remark I made in closing, that a much weaker solution can be used with equal benefit. I commenced with a 4 per cent. solution, and have reduced it in some cases to 2 per cent. and the results were the same; only in using the latter I used a little bit more. It may have the same effect he refers to, so far as the tissues are concerned, on account of the presence of what may be termed a foreign body. I also think constriction of the finger under pressure bandage may have something of an anesthetizing effect. I have amputated on several occasions four fingers. I would inject one with cocain, amputate it, then inject another, amputate it, etc. I have not used it in cases of circumcision, but for the purposes mentioned in the paper I have used it for the last two or three years exclusively.

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REPORT ON AMPUTATIONS AT THE JUNCTURE OF THE TARSAL AND METATARSAL ARTICULATION.

BY W. J. GALBRAITH, M.D.
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I regret exceedingly that neither of the cases I desired to exhibit at this meeting are here. Owing to the fact that I am obliged to return to Omaha to-night, they will not be here in time for me to exhibit them. I secured transportation and gave them the necessary means to pay their expenses, but some unavoidable accident has delayed them.

I believe the treatment that was applied to this case and one other since that I have operated is entirely unique. It is very difficult for me to describe to you accurately the treatment this case received. It was impossible for me to make a Lisfranc operation on account of the destruction of the tissues a little proximal to the tarsal and metatarsal articulation. In the customary treatment of these cases a Symes or Pirogoff operation would undoubtedly have been made. I explained to the patient, who was a railroad man, that I would like to experiment to a certain extent upon this foot, that the experiment would not be injurious to him in any manner, only that it might retard for two or three weeks the repair in his case. He was very willing that I should try anything that would save any part of his

foot. The tissues, as in many railroad injuries, were completely pulpified, lacerated and contused. The point of complete separation, as I have described, was at the tarsal and metatarsal articulation. You will all readily understand the amount of retraction there is in the skin after an injury of this kind. I proposed to the man that I make a complete section, that is, taking my knife and trimming all the tissues transversely at the seat of the injury across the foot, going back just a little above the metatarsal articulation. The head of the metatarsal bone was removed by the saw or forceps, I do not remember which. It was my object to cut it as high up into the tissue as possible. Thorough antiseptic precaution was preserved throughout the entire operation. A moist dressing was applied for four or five days, and about this time it was changed and a stimulating dressing, composed of equal parts of sterilized balsam of Peru and sweet oil was applied directly over the wound, in order to stimulate and secure as early as possible a granulating process. After securing, at the end of about eighteen or nineteen days, a good bed, so to speak, of healthy granulations, I skin-grafted after the method of Thiersch with excellent results.

Now, I believe, in fact I am positive, that I saved at the least several inches of that man's foot, enabling him to perform the duties of a switchman nearly as well as he did before he met with the accident, It would be utterly impossible with a Symes or Pirogoff operation for a man to perform these duties. You know as well as I that many surgeons to-day, especially in the East, are performing in preference to the Symes and Pirogoff operation an amputation of the middle or

lower third of the leg. Now, what is the result? In this case we have succeeded in getting a foot that a man can perform his duties with. He goes about nearly as well as he ever did. And the result to the railroad is what? This man's case was settled for $200. If a Pirogoff operation, or an amputation at the middle third, which is often preferred, had been performed, the amount paid would have been perhaps $2,500.

Now there are a great many points to be observed in the treatment that I have applied to this case, and the other one which has been equally as successful. You all readily understand how slow granulation takes place over a cartilaginous substance. It requires weeks and even months, and by the time you have secured a granulating surface over the articulating surface of the bone, the surrounding granulations are exuberant, broken down, or indolent, and your skin-grafting is a failure. The object is to secure as good a bed of granulations and at as early a date as possible, and I believe you will accomplish the same results that I have in this case.

DISCUSSION.

DR. H. REINEKING, of Sheboygan, Wis.—I was very much interested in the report of Dr. Galbraith, on account of two patients which I have recently had occasion to see. I will first speak of a case Dr. Etley, of New Richmond, presented at the last meeting of the Wisconsin State Medical Association, a case where all the soft tissues of the sole of the foot had been torn off in a railroad accident. As he described it, the bone was perfectly bare. He resorted, not to the skin-grafting of the tissues, but to skin transplantation after the plan of Krause. He showed the patient at that meeting and the result was indeed beautiful.

In a case that I treated recently, an injury resulting from a

boiler explosion, the injury consisted in a compound fracture of the olecranon process with a severe scalding of the entire posterior surface of the arm. The burn was of the third degree. The body was also extensively scalded, but in that location just where the elasticity was most wanted after the bones united, there was a very deep burn. Here I resorted to the same mode of skin transplantation, transplanting the whole thickness of the skin down to the adipose layer. The area covered had a length of fourteen inches, and at the widest portion, four to six inches in width. Four elliptical portions were taken from the patient's thigh and cut into small sections and transplanted to his arm. Every particle of this skin, I am glad to say, adhered and in about two weeks' time success was assured.

This process of skin transplantation I believe superior to Thiersch grafting. It is not necessary to have a granulating surface, in fact the granulations were all carefully scraped away in this case. According to Krause, skin grafting in this way can be made on bare bone, cartilage, fibrous tissue, or almost any tissue in fact as long as the surface on which we transplant is absolutely aseptic. Asepsis is the one great requirement for success in these cases. It is not necessary to first have a healthy granulating surface; it can be done in recent injuries; it can be done in various shapes after scraping away the entire skin and, as I say, the healthy granulated surface is not essential.

DR. MAYNARD - In connection with this case, and in the same line of thought, about 1876, or 1877, I learned how to borrow skin for grafting. I did not know anything about grafting then, but I found in an arm injury, for instance, if you cut too close and get a slough just take a piece of strap and put a pine shingle on and make a little steady pulling and it is wonderful how much skin you can borrow with which to cover your granulation. I seldom graft if I can borrow. Make a steady pressure and it is wonderful how the skin will give and will grow. It will apparently make new skin. It probably would not have answered in Dr. Galbraith's case, but had it been my case, I should have put on a little slow tension with a rubber band or a rubber strip over the front and base of the foot, and would have tried to get it that way. If you will try this you will be surprised with the results you will get.

DR. BEVAN—I would like to make one remark in the same line of work on the importance of conservative work in finger and toes and hands in railroad surgery. For a number of years I have made it a point practically never to make a peremptory amputation of any part of the hand after a railroad crisis, except where the part was entirely crushed from the hand, and have not cut away any portion of the tissue, except that which was entirely destroyed. Next in this connection, is the value of a wet boracic acid or borax dressing. I have always employed wet dressings and kept them continually wet in these cases until I could determine the amount of tissue that had been destroyed. Borax or boracic acid in the strength of about one to one hundred is not antiseptic, but it does inhibit the growth of germs and I have repeatedly taken fingers, which were turning black and becoming gangrenous, and wrapped them in wet boracic acid and watched them for from ten days to two weeks. They have simply mummified without any infection. One point I would like to mention in regard to Thiersch's graft and skin transplantation: Skin transplantation is the ideal operation if it can be made successfully. It can not be made successfuly in enough cases to warrant us in employing it. Skin transplantation certainly in large masses, as far as my own experience is concerned, and it is fairly wide in this matter, has not been successful in more than about half of my cases; in about half the cases there has been failure of fusion, and this same experience has been met with in the hands of my colleagues at the Presbyterian Hospital. There is this objection to transplantation, that if you remove a large area of skin and it fails to unite you have done an injury to the patient and he feels that he has been to a certain extent mutilated by the removal of the entire thickness of his skin. In the Thiersch graft, where you split the skin, you can remove fifty square inches from the patient's thigh, and in a week he is practically as sound and well as ever. So I do not believe that we could make this statement that skin transplantation will take the place of the Thiersch graft because of the facts that I mention.

DR. REED—I only have a word to say. I regret I did not hear all the doctor's report. I wish to speak only in reference to the manner of transplantation of skin. The objection

spoken of by Dr. Bevan is one which we all know patients are liable to make; that is, in being skinned themselves in some part to cover some other part. It is sometimes necessary to borrow integument from some of their neighbors, and it seems to me that the use of the frog skin in cases of this kind obviates to a large extent this objection, and would give, so far as my experience is concerned, practically the same results. I know of several instances in which the frog skin has been used. One I recall in a patient who had a very large ulcer. This, however, was a varicose ulcer, but it answers the same purpose to demonstrate the use of the transplantation of skin in a case in which I had little confidence. In this case we used a live frog and skinned off the integument of the abdomen and placed it over the ulcer and the results were quite gratifying, rapid, and not only rapid but they were perfect, just as much so as in another case that was operated about the same time in which we used the Thiersch graft. I simply make this suggestion in the hope that it may help out in cases of this kind where we can not get integument safely from the patient or his friends.

DR. KIBLER One word on the subject of skin graft. I have a plan of my own on that point which I have not said much about. I do not use skin at all, but I use the epithelial tissue, the rough, horny epithelium that you get from a working man's hand. I recently had a case of skin injury received by an elderly gentleman sixty-odd years old, from scalding, some four hundred square inches in area, and to-day his skin is perfect and his muscles are seemingly as limber as ever, without much contraction. Simply take the rough, horny epithelial tissues which you will find upon the palm of a working man, or upon the sole of the foot of any man, and you have a good substance for grafting as you can possibly ask for. Try it.

A MEMBER I will ask the doctor to give the technique.

DR. KIBLER First the ulcerating surface should be washed thoroughly with a boracic acid solution; then take a little piece of thin tissue from this horny surface that I speak of, not thicker than tissue paper and not larger than a split bean perhaps. This is placed directly upon this raw surface, covering it with a protective, over which is put adhesive plaster. When the plaster is removed it does not disturb the grafting whatever, whereas, if you should put the plaster directly on the

grafts themselves, they would likely be withdrawn whenever the plaster was removed. This little mackintosh covering or oiled silk, if you wish, affords a substance to give you the finest results.

CHAPTER IV.—FRACTURES.

AN UNUSUAL CASE OF FRACTURE OF THE SKULL.

BY F. H. PECK, M.D.
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I have to beg the indulgence of the Academy for bringing up in a very new and crude way a history of a case which has always been extremely interesting to me, and I will explain how it is that I am unable to give more complete data of the case. It is a case of fracture of the skull which occurred during my service at the State Emigrant Hospital, New York, when that institution was located upon Ward's Island and under the government of the New York commissioners of immigration. Some three or four years following my service the department was taken out of the hands of the New York State commissioners of immigration and put into the hands of a single-headed commission which was under the general government, and the hospital was removed from Ward's Island to Ellis Island in the harbor so that my data in regard to the case are rendered inaccessible. It is a case I should have reported at the time it occurred, excepting that I was very young in the profession and thought that it would be rather presumptuous for one who was but a recent graduate to rush into print. My only apology for now presenting it is that the case is

interesting to show the amount of injury which the skull and its contents will occasionally tolerate, not on account of good treatment, but perhaps in spite of the treatment, and the fact that the case has never been presented before.

In the summer of 1882 an Italian, about thirty years of age, belonging to a construction gang on the West Shore Railway, then being built, was admitted to my service in the state Emigrant Hospital, New York, with a compound fracture of the bones of the skull, and with the following history, partly obtained from the Chambers Street Hospital, and partly from the patient after his restoration to complete consciousness: Three days prior to coming under my care, while at work in a rock-cutting, he was instructed to dig out a blast which had failed to explode, with the result that the heavy charge exploded in his face. He was taken across the river to Chambers Street Hospital, and on the third day transferred to the State Emigrant Hospital, on account of the development of erysipelas in the margins of the wound, as no septic cases were allowed to remain in the Chambers Street wards.

Physical signs on admission were as follows: A compound fracture of the frontal bone extending transversely across the forehead just above the frontal eminences and below the hairy margin of the scalp. The wound through the soft tissues was about five and one half inches in length and gaping to about one and one half inches at its widest part; extending from a point about two inches superior to the right external angular process to a point about equally distant above the middle of the left superciliary ridge, and communicating freely with the cranial cavity and

brain through the subjacent fracture and an equally large laceration through the meninges. The cutaneous surface surrounding the wound for a distance of about an inch from its margins was swollen and reddened with an angry erysipelatous blush. The bottom of the wound was filled with detritus composed of necrosed brain tissue, small fragments of rock and some loose bony fragments. The fracture could be traced beyond the limit of the open wound to the left external angular process; thence it extended through the roof of the left orbit, emerging in the nasal bones which it traversed obliquely downward, through the right malar bone, and thence outward and upward to its point of origin near the superior extremity of the right temporal ridge of the frontal bone. It extended across the base of the anterior portion of the skull from the left external angular process through the left orbital plate of the frontal bone, and posterior to and including the right orbit, or the greater part of it, to a point on the external aspect of the right great wing of the sphenoid, including in the parts fractured from the rest of the cranium nearly all of the frontal and ethmoid, and portions of the sphenoid, nasal and right malar bones. This was proven by the mobility of the portion fractured off, which was so mobile as to move back and forth with every cardiac impulse transmitted through the cranial pulsations, and by the fact that the upper right portion of the face, including the right orbit and globe of the eye, was advanced anterior to the plane of the upper left portion of the face and left eye. This obliquity of the frontal structures and eyes remained after the wound was healed, the right eye being about five eighths of an inch anterior

to the plane of its fellow, and the facial deformity was well shown in a tin-type which he brought me, but which I unfortunately left at the hospital at the end of my term of service.

The patient was in a condition of mild stuporous delirium, answering questions when aroused, but irrationally and *mal a propos*. Through loss of notes I am unable to give clinical record of pulse and temperature.

Confronted with the above conditions I considered his injuries necessarily fatal, and believing I could do no harm in contributing to the fatal issue, I was extremely bold in exploring and cleaning out the wound in the cranial cavity, introducing all the fingers of my hand into the cranium so that in the manipulation the anterior portion of the right anterior lobe of the brain rested in my hand on the palmar surface of the fingers. In this manner, and assisted by irrigation I removed the detritus, including, I should think, as much as half an ounce of softened and detached brain substance. The selection of dressing next perplexed me. You will remember this was in 1882 in the early days of antisepsis, and the only agents then in use to modify septic conditions were carbolic acid and iodoform, neither of which I wished to apply to a wound communicating so freely with the brain on account of their irritant properties. I contented myself with applying compresses kept constantly saturated with cold water, and to my surprise the patient immediately and steadily improved; the erysipelatous redness, fever and delirium disappeared within a week or ten days: the wound granulated and cicatrized from the edges, and he progressed to an uneventful recov-

ery, and was discharged cured about two months after his admission to the hospital. After his delirium subsided he showed no impairment of mental powers nor loss of function save the sense of smell, which was completely lost through rupture of the olfactory filaments.

On his discharge I asked him to report after the lapse of two or three months that I might further examine as to his cerebral functions, and at the end of two months he presented himself again bringing a picture showing his facial deformity as stated above, and showing no mental deterioration.

DISCUSSION.

DR. DALBY—The paper just read and case cited by Dr. Peck—skull fractures and to what extent these fractures may go and still the patient recover—simply adds another to the already long list. We have seen compound fractures in such aggravated shapes that seemed as though recovery would simply be impossible. As he stated in the paper, in this case he got well in spite of any medical attention; I think a great many of them do. In cases of fractured skull as they come under the railway surgeon's attention, beyond cleansing the wound and making it as aseptic as possible, relieving the pressure, is about as much as we can do. The case he cites is certainly an interesting one, but, as I stated, only another of a long list of these horrible fractures where patients recover in spite of all we may do and may not do. As I have stated, there is very little in such cases that can be done anyhow, even in the surgical field. After we have made the wound aseptic and relieved the pressure we have performed about all the surgeon can do.

FRACTURE OF THE FOREARM COMPLICATED WITH DISLOCATION.

BY E. GRISWOLD, M.D.
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The mechanism of the human hand, with its great variety of movements and its marvelous adaptability to the purposes for which it is intended, furnishes a strong evidence against the doctrine of those who have doubt as to the origin of man. The best productions of artificial hands, by the highest development of human art yet made, have fallen far short of the natural member, in a mechanical sense, and it is only in that sense that any artificial approximation can be made. The vital principle, emanating from the brain and spine is necessary to the perfection of this organ, and as much as the man, the mechanician or the artist resembles his Creator, he is still unable to control that vital principle, as against natural physiologic activities, and these activities are maintained by the forearm, which may be said to be the dynamo of the hand, and whenever from any cause this organ is injured so that the normal action of its muscles is impaired the movements of the hands are more or less curtailed. The skeletal structure of the forearm, consisting of the radius and ulna, is so constructed that it has a wide range of motion, not the least important of which is its rotation, which extends beyond a semicircle. When

the hand is fully supinated these bones lie nearly parallel with each other. when pronated the radius lies in an oblique direction, across the shaft of the ulna with its articular carpal end on the inner side instead of on the outer side of the ulna, as it is in supination. The radius attached to the outer condyle of the humerus above, by a slightly concave surface, and to the outer surface of the olecranon process of the ulna by the coronary ligament, which gives it free rotary motion, is chiefly concerned in these acts of supination and pronation. The head of the radius constitutes but a small portion of the bulk of the large joint, of which it forms a part, but if measured by its functions we must admit that it is of considerable importance. At its carpal end we find it articulates with the three principal bones of the first row of the carpus, namely, the scaphoid, semilunar and cuneiform and practically forms the whole of the wrist joint. The ulna performs only a minor part, and does not enter into the formation of the joint. This bone, with its little head and big base, controls for the most part the actions of the hand, while the brachialis in front reinforces the power of the biceps flexor cubiti which is attached to the tubercle of the radius and flexes the forearm. The large size and complicated form of the ulna at the elbow joint, with its greater sigmoid fossa fitted to the inner condyle of the humerus, its lesser sigmoid fossa fitted to the head of the radius, its coronoid process which forms the inferior boundary of the greater fossa, and its muscular attachments and powerful ligamentous involucrum, all combine to place it in strong contrast, both in structure and function, to its carpal end. Of the

twenty muscles of these two bones, five are attached to the inner condyle of the humerus, and act as flexors and pronators of the fingers, wrist and hand. Three of the deep layer, lying beneath these, originate from these two bones below the condyles. Of these, two, the flexor longus pollicis and the flexor profundus digitorum, as their names imply, are flexors, pure and simple, and one, the pronator quadratus, is purely a rotator. In the radial region or border, we have three muscles all arising from the external condyle and the external condyloid ridge of the humerus. One of these is attached to the styloid process of the radius and therefore acts as a supinator, the other two acting as extensors of the hand. There are nine muscles on the back or dorsal aspect of the forearm. These, the muscles of the radial and posterior brachial regions, comprise all the extensor and supinator muscles and act on the forearm, hand and wrist. They are the direct antagonists of the pronators and flexors. The anconeus assists the triceps in extending the forearm. The supinator longus and brevis are the supinators of the forearm and hand, and the former acts as a flexor if its action is continued after supination is complete. The extensor carpi radialis longior and brevior and the extensor carpi ulnaris muscles are the extensors of the wrist, and continuing their action, serve to extend the forearm upon the arm. They are the direct antagonists of the flexor carpi radialis and ulnaris. The bones of the forearm, when extended and fully pronated are nearly in line with the long axis of the humerus, but when fully supinated the forearm represents a divergence of about 10 degrees outward. Neither the elbow nor the wrist joints are at right an-

gles with the long axis of the humerus or the bones of the forearm. That at the elbow slanting toward the inner condyle, bringing the trochlea for the great scaphoid fossa of the olecranon at a lower level than the articular surface for the radial head, while the styloid process of the radius extends lower in supination than that of the ulna. These data have some importance when attempting to make a differential diagnoses as between fractures and dislocations. The blood and nerve supply of the forearm and hand are ample in the normal state, but lesions of these vessels and nerves in cases of fracture, especially so in crushed fractures, have much to do with the results of treatment; for large destruction of muscles may be present without serious functional impairment if the blood vessels and nerves are but slightly injured, or not injured at all. As regards the nerve supply, if we know the distribution and the degree of injury the nerves have sustained, we may judge pretty well as to the probability of paresis or paralysis supervening. The distribution of the median, ulnar and musculospiral, the latter mainly by its radial branch, while not exactly uniform in all subjects, is sufficiently so for all practical surgical purposes. These incomplete anatomic data of the forearm may be helpful in the diagnosis of its fractures and dislocations. Fractures of the forearm are of frequent occurrence, especially those involving the lower end of the radius. Sometimes they only involve a portion of the articular surface of the radius, sometimes the articular surface is badly fissured and the fracture extends some distance up the shaft. There is an occasional separation of the apophyses in young subjects, and impactions are not

infrequent. The deformities caused by most of these fractures, especially in Colles fractures, is no doubt largely due to the force which produces them. This is usually a fall on the palm of the hand, the weight of the body acting through the limb with sledge-hammer force so that the fractured lower end of the radius is driven upward beneath the supinator and extensor tendons and is pretty firmly held there, not so much probably by the contraction of these muscles as by the binding power of their tendons. If the force of the fall has been very great, so as to cause considerable displacement, the ulna is almost certain to be either dislocated or fractured. If a Moore's dislocation is the result, this may greatly add to the difficulties of the treatment. The intervention of blood clots or other tissues and agencies sometimes render complete coaptation difficult if not impracticable and when it is successfully attained the spasmodic action of the muscles often render it impossible to maintain it. Dr. E. M. Moore's demonstrations of the dislocation and occasional fracture of the head of the ulna as an accompaniment of fractures of the lower end of the radius seem to have attracted less attention than they deserve. Several cases of this kind have fallen under my observation and a still larger number in which there appeared to be a partial dislocation of the head of the ulna. Dr. Moore met with several cases in which there was dislocation of the head of the ulna accompanying fracture of the carpal end of the radius, and in which the ulna was driven into, or partly under the annular ligament. This malposition rendered coaptation of the fragments of the radius impossible until the imprisoned head of the ulua had been liber-

ated. If the fracture of the radius is not completely reduced and a shortening results the obliquity of the radio-carpal articulation is increased, the radius shortened and the head of the ulna rendered more prominent, causing a conspicuous deformity. This deformity may also happen, but generally in a less degree, if the radius is fractured higher up, and reduction and coaptation have not been perfect during the period of bony union. Separation of the apophysis may cause a good deal of deformity and be easily mistaken for a dislocation, but occurring as it always does in young subjects in whom muscular rigidity is generally inconsiderable, reduction is generally easy and the crepitus is differential. Gunshot fractures of the carpal end of the radius sometimes happen without much displacement. The cancellous structure of this end of the bone with its thinned outer layer of hard tissue makes it quite possible for a small solid shot to perforate it without causing much splitting, splintering or bone displacement. It is, of course, quite different when the radius is shattered by a charge of finer shot. The ordinary causes of fractures of the lower end of the radius are liable to be in operation in railroad and machinery accidents, but in these latter accidents we are more likely to find the soft parts crushed and so badly injured as to be devitalized. Fractures of the shaft of the ulna, unless caused by direct force, are not infrequently complicated with dislocation of the head of the radius. This is more apt to be the case if the fracture has been produced by falling on the partially extended palm of the hand as in most cases of fracture of the lower end of the radius. The shaft of the radius being in these accidents too strong to yield, and the

force being great, the ligaments of the head of the radius give way and it is forced upward on the anterior surface of the external condyle of the humerus.

Fracture of the coronoid process of the ulna is very rare, except as a complication of dislocation of the ulna backward. The tendency to muscular displacement, in this little fracture, is inconsiderable as the only muscle attached to it is the brachialis anticus, and its fibers are so spread out on and over the ulna below, that very little traction on the fragment can occur unless these fibers are torn by the injury. This process is so small that it is not always easy to determine when it is fractured, especially when the swelling has become considerable before examination. It may, however, occasionally be felt as a small movable body under the skin of the part by careful manipulation. Fracture of the head or neck of the radius is more frequently met with in connection with dislocation of the olecranon accompanied by fracture of the coronoid process than otherwise. This too is sometimes of difficult diagnosis, but when there is not too much swelling the lesion can generally be distinguished by the pain or tenderness, or sometimes by the crepitus and pain on supination and by the evident want of motion of the head when rotating, or by attempting extension or shortening of the shaft of the radius. If there be fracture of the external condyle with the fracture of the head or neck of the radius the latter may easily be overlooked. A fracture of the radius between the insertion of the biceps and the pronator radii teres is liable to result in a bad cure unless the situation of the fracture and its anatomic relations are appreciated and the action of the biceps on the upper

fragment, and the pronator quadratus on the lower are antagonized. This biceps being attached to the back part of the bicipital tuberosity rotates the upper fragment outward and produces more or less complete supination, while the pronator quadratus pulls the lower fragment in the opposite direction toward the ulna and produces pronation. Now, if these displacements be real, it is easy to see that even if the ends of the bone are brought into line and osseous union effected, the limb will be sadly defective, unless the supination of the upper fragment and pronation of the lower can be corrected. Consolidation would, in this condition of the parts, result in almost complete loss of pronation and supination, but relaxation of the tenden of the biceps by a rectangular position of the forearm together with manipulation of the two fragments, would rotate, the one outward and the other inward and bring their normal transverse axes to correspond with each other. This fracture should then be dressed with a rectangular splint.

It begins to appear that my subject is too large to admit of full and specialized consideration in detail within time limits, and so, after giving a short history of a private case and then some statistic facts, with a few comments on shot fractures of the forearm my time will have been fully occupied.

John L. Allen, a fair-haired, light complexioned boy, aged 15, accidentally discharged a heavy load of shot into the ulnar side of the right arm in June, 1883. The ulna was broken from about the junction of its middle and lower thirds to near the coronoid process and the muscular structures largely carried away. The flexor and pronators and portions of the

extensors were nearly destroyed, close up to the joint, a considerable portion of the interosseous, together with the ulnar artery and nerve were also destroyed. He nearly bled to death before he got assistance. The artery was tied at both ends, the ulna cut off smooth at both ends, and the loose fragments removed leaving a hiatus of four inches in its continuity. The arm was dressed with lint and put on a pillow covered with oil silk and a syphon supplied with cold water made to play on it day and night continually. There was no inflammation or suppuration. It granulated and closed in a few weeks without incident. He obtained a business education and is a book-keeper. The little finger and the ring finger are flexed in a state of permanent contracture. The other fingers and the thumb have a large range of motion, and he says the arm is strong. The median and radial nerves were not much injured. The usefulness of this arm furnishes a striking contrast with the conditions of most of those who suffered similar or even less mutilation in military practice. The following statistics are from the Surgical History of our Civil War, Vol. 11, beginning at page 921.

There were thirty-two cases of injuries to the bones of the forearm classified as partial fractures. They were not cases of solution of continuity but were chipped or grooved by the passage of balls across their surface. They involved the ulna in twelve cases, the radius in fifteen, both bones in one, and four were not specified. Twenty-eight of these cases were treated conservatively and of these two died. The other four were amputated in the upper arm and two of these died. So that the mortality of these thirty-two cases of par-

tial fracture was 12.5 per cent., a larger percentage than followed in the treatment of cases of complicated fractures of these bones. In military practice the larger share of fractures of the bones of the forearm are in the ulna, the radius being next in number and both bones third. There is a complete record of 5,194 cases of shot fracture of the bones of the forearm. About three-fifths of these cases were treated without operative interference with a mortality of 6.4 per cent. The radius and ulna were both fractured in 1,291 cases or a little less than one-third of the whole number of cases in which the seat of the fracture was specified. This group as might be expected contains a larger number of cases requiring operative interference than the others in which a single bone only was involved; 323 of these 1,291 cases were treated conservatively and there were 299 recoveries, 103 of whom returned to modified duty and 196 were discharged. These recoveries were left with more or less disabled limbs, very few of them having much rotation left. Pseudo-arthrosis occurred in two cases. The death rate was 7.4 per cent.

Fractures of the Ulna treated Conservatively.—The results here in 1,044 cases, all but 5 of which were determined, were recoveries 980, deaths 59, a mortality 5.6 per cent. Of these 980 recoveries, 490 returned to modified duty and 490 were discharged. Eighteen of these recoveries had secondary hemorrhages. In three, ligature of the brachial, in five, ligature of the ulnar and in four, ligature of the radial was practiced. The other six recovered under the use of styptics and compression without ligature.

Of the 59 deaths out of the 1,039 determined cases

of shot fracture of the ulna the greater number were caused by pyemia and gangrene. Of 999 shot fractures of the radius treated during the war the proportion of deaths is rather less than resulted from fracture of the ulna, but the degree of disability is greater. Of the 949 of these cases that recovered 445 returned to modified duty and 504 were discharged—a considerably larger proportion than was discharged among those recovered from fractures of the ulna. Quite a number of the recovered cases had secondary hemorrhage requiring the ligature, a few had hospital gangrene, a few erysipelas, and many had osteitis, necrosis and exfoliation of bone. In some instances long cylindrical sequestra were removed. There were 147 cases among the recoveries in which considerable sequestra were removed. Of the fifty fatal cases in this series five died of pyemia, in six secondary hemorrhage caused death, two died of tetanus, one from gangrene and two of erysipelatous complications, but the majority of the deaths were reported from exhaustion and from the various affections arising during their hospital residence. Hospitalism was then an important factor in results. In aggregation out of the 5,194 cases of shot fractures of the forearm 2,970 were treated conservatively. The graver complications among these were comparatively infrequent. There were, however, twenty-seven deaths from pyemia, four from tetanus, thirteen from secondary hemorrhage. There were fifty-seven cases of severe secondary hemorrhages treated out of this large series requiring in different cases ligature of the brachial, radial, ulnar and interosseous arteries.

Excisions in the continuity of the bones of the fore-

arm were practiced in 986 out of the 5,194 cases of shot injuries of the forearm, with a mortality of 11.2 per cent.; 496 of these excisions were of the ulna, 413 of the radius and 59 of portions of the shafts of both bones; 18 cases were not specified as to the bone or part of it that was excised. Excisions were classified as primary when done before swelling or inflammation occurred, or in general within thirty-six to forty-eight hours from date of injury; intermediate when done later, or within twenty to thirty days, and secondary when done after thirty days. Primary excision of one or both bones was done in 665 of the cases with a mortality of 71,—10.6 per cent. Five of the cases were undetermined. The excision involved the ulna in 321 cases, the radius in 291, both bones in 40 and in 13 the seat of the excision was not specified. Forty-four of these cases were Confederate soldiers.

Of the forty excisions of both bones, thirty-four were successful as regards the saving of life, but eighteen of them afterward required amputation, and among the twenty-two who retained their arms not a single good result was obtained. In fact the recovered cases who retained their limbs were worse off than if amputation had been done as the limbs were useless appendages and a hindrance. Excision of the shaft of the ulna shows 290 recoveries. The length of the shaft removed varied from one to six inches, in one case the entire diaphysis was removed. In one of this series excision was made in the radius of the right arm and the ulna of the left. This man died in 1872 and a short time before his death pension examiner, O. M. Stockwell, of Port Huron, Mich., reported

his "disability is almost equivalent to the loss of both hands" and in general the ulterior pension reports in these cases show a disappointment in regard to the expected usefulness of the limbs. Of 413 primary excisions of the shaft of the radius 256 recovered.

Table 126 gives 589 cases of recovery after primary excisions of the bones of the forearm for shot wounds (36 were Confederate) of which 147 were returned to modified duty and 406 discharged from the service.

Intermediary Excisions of the Bones of the Forearm.—Of these 149 cases with a mortality of 19.4 per cent., or 29 deaths are reported; 9 cases involving both bones, 64 the ulna and 47 the radius. Among the 120 cases of recovery after intermediary excision of the forearm were eleven of secondary hemorrhage, three consecutive amputations in the forearm and six in the upper arm. Of the twenty-nine deaths of this series the greater number were from pyemia and pyemic complications. None of these were done on both arms, eighteen were of the ulna and eleven of the radius. Unsuccessful consecutive amputations were done in the upper arm in five cases. The fatal issue in one of them was thought to be due to the concomitant fracture of the spinous process of one of the dorsal vertebræ. There were forty secondary excisions made after thirty days from date of injury. Seven of these involved the shaft of both bones, twenty-one of the ulna only, and eleven of the radius and one not specified. There were four fatal cases of these secondary operations. Beside the different series of cases above shown in which a classification as to date of operation was given, there were 132 cases of excision of the forearm not classified, in which the

small mortality rate of 4.3 per cent. was reported.

RECAPITULATION IN AGGREGATE.

This large number of excisions, 2,251, of the bones of the forearm compares unfavorably in results with the larger number, 2,943 treated on conservative principles, both as regards mortality and subsequent usefulness of the limbs. Could aseptic, or even antiseptic surgery be made available in future wars, the results would no doubt be improved, and resection and amputation would be found unnecessary in a large portion of cases in which they were practiced in preantiseptic times.

The mortality 2,943 cases of shot fracture of the forearm treated by conservatism was 6.4 per cent. and of the 965 treated by excision 11.2 per cent. and of 1,256 treated by amputation primarily or consecutively performed, the death rate was 16.3.

In studying these statistical results we note with interest if not surprise the great difference in the mortality of cases treated conservatively and those treated by excision or amputation. The fact, however, is not to be overlooked that the milder cases were as a rule treated conservatively and the more severe by excision or primary or conservative amputation. Unless antiseptic surgery can improve the results of excision of the bones of the forearm the operation ought to be abandoned in military practice and the same remark may apply equally to railroad surgery.

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THE USE OF GOLD FOIL IN FRACTURES OF THE CRANIUM AND RESULTING HERNIA CEREBRI.

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The three cases related in this paper are offered as illustrations of a slight advance in hetero-plastic attempts, and are unique in that they were done on the contents of the cranium, and not on the cranial walls themselves. The nearest approach I have found to the attempts I have made were by Weir, of New York, who did pioneer work in using gold foil to prevent adhesion of the dura to the cranial bones after serious fractures and removal of pieces of bone from the cranium, I have extended the use of the foil in one case to plug up the cavity in the cerebrum itself, and in two other cases to replace destroyed dura—not with the idea or indication of preventing adhesion, but of replacing the obturator function of the lost membrane, and so prevent a further escape of cerebral tissue and subsequent development of a hernia cerebri.

The number of cases is too small to serve as an authoritative guide for future routine practice; these cases indicate, however, beyond the shadow of doubt the extreme tolerance of the brain and cranial contents to foreign bodies, and may encourage further attempts in even more radical directions. For in-

stance, it happened once to me in operating on the cerebrum to open the lateral ventricle, and I found no ordinary plug nor suturing nor compression would prevent the constant escape of cerebro-spinal fluid, which finally caused the death of the patient. Having the experience of these cases in mind I should not now hesitate to form a new roof for the lateral ventricle with gold, or if need be plug its cavity with a cup of gold. The gold foil might also be useful in controlling the escape of cerebral tissue or help fill the cavity left after removal of tumors from the brain, and so on. It must be understood that this kind of hetero-plasty demands the strictest aseptic technique and most careful attention to details.

A most valuable adjunct to the specific use of the gold foil inside the cranium, is the inhibitory action it exerts against the growth and development of microörganisms. This most beneficent quality was discovered at Johns Hopkins Hospital by Drs. Welsh and Halsted. It is true also of silver foil and metal plates and sutures generally which will resist the corroding action of the animal tissue, and fluids. This inhibitory action against microörganisms may explain the remarkable aseptic course of the second and third cases, after the use of gold foil when the conditions previous to the operation were particularly favorable for subsequent suppuration.

The gold foil I have used has been next to the thickest foil ordinarily used in dentistry, I sterilized it by a prolonged immersion in a 5 per cent. solution of carbolic acid and just before using it washed it thoroughly in a sterilized normal saline solution. During the operation a warm sterilized saline solution

was used for all purposes of douching or washing about the wound or within the cranium. I invariably prefer to remove by gentle douching any detached cerebral matter, clots, or debris from the cranial cavity, rather than by swabbing with any sort of gauze or sponge. I have found capillary drainage quite sufficient in these cases. I have used stout catgut, or a narrow piece of sterilized iodoformized gauze as drains.

The arguments specially in favor of these heteroplastic attempts, rather than autoplasty, are two-fold. 1. After a stock of gold foil has been obtained it is always ready and is easily employed, whereas autoplasty, after complete destruction of an area of dura or cerebrum, is extremely difficult and usually indeed impracticable. 2. Hetero-plasty introduces a substance which if it prove an irritant does so simply by its presence, as a mechanical result, so to speak, and it acts as an efficient inhibitor of microgenesis, whereas autoplasty may, and commonly does, result in necrobiosis and infection of the already badly injured tissues. The former may be removed *in toto* without much disturbance and with relief to the symptoms, whereas in the latter case the result of the death of the organic graft is usually irreparable and far reaching.

The cases are as follows (The first case was published a few months ago in the *Medical News*. The other two cases are given here for the first time):

Case 1.—Cornelius B., a negro, 28 years of age, was brought to the hospital in an unconscious condition on the night of April 4, 1893. The ambulance surgeon was told that while the patient with a companion was out driving, Cornelius, by what means or agency could not be discovered, was thrown to the

ground and kicked by the horse, becoming immediately unconscious. He was forthwith taken in charge by his companion and sent by railroad a distance of some twenty-odd miles, and finally was received at the hospital, still unconscious, three or four hours after the injury. No dressing or covering of any sort had been placed over the wound. Examination showed no injury anywhere, not even an apparent bruise, except on the right side of his head, where there was a *punched-out* sort of wound through the scalp and bone and deep into the cranial cavity. The location of this wound was 6.5 centimeters above the external auditory meatus and 2 centimeters in front of a line perpendicular to the external auditory meatus; it was 5.5 centimeters behind and 3.5 centimeters above the external angle of the frontal bone. The wound in the scalp was round, but a laceration extended backward about 3 centimeters. The surrounding scalp was not lacerated or contused. Hemorrhage had entirely ceased and had not been profuse. The man's general condition was good. Although he was unconscious, enough reflex remained to cause him to move about when the wound was manipulated. After shaving and carefully cleansing and disinfecting his head he was chloroformed, the external or scalp wound was enlarged and the bone freely exposed. It was found that the depressed fracture of the bone involved an area of a little less than 2 centimeters and that all of this bone was driven down at almost a right angle to the cranium into the cerebrum, so that there was a sharply-defined rim of bone, with some radiating linear fractures, and about 3 centimeters beneath, from the inner table of the cranium, the comminuted fragments lay imbedded in the cerebrum. Outside of this bone the scalp had also been punched out and the fragment was lost. The opening in the bone was enlarged and by careful manipulation the fragments were lifted out of the cerebrum with a pair of narrow forceps. A few spiculæ were so small and sharp and deeply imbedded that much care was required to locate and remove them. When the fragments were finally removed free hemorrhage took place from the cerebrum, but was checked by plugging the cavity with iodoformized gauze. Something like 15 cubic centimeters of lacerated cerebral tissue were washed away with a gentle stream of warm sterilized saline solution. The dura was lacerated to shreds

and it was quite impossible to close the gap in the membrane. I concluded to pack the whole cavity with iodoformized gauze, and, by careful asepsis, endeavor to obtain healing by granulation. Accordingly, a careful dressing with an outside pressure bandage was applied and the patient put to bed. He stood the operation very well, reacted quickly, and under morphin passed a quiet night. The next day he was quite conscious, answered questions readily and had no paralysis. There had been considerable oozing and the dressings were saturated with blood. I changed the dressing. In spite of the greatest care there was an escape of more cerebral tissue, and as there was no membrane or scalp to help retain it I saw I should have trouble to prevent the escape of brain tissue whenever I dressed the wound, and every prospect of a final hernia cerebri. I replugged and redressed the wound as before and concluded to wait a day or two. I recollected, in thinking over the matter, that Weir had recently used gold foil to prevent adhesions between the dura and cranium and scalp, and had found it non-irritating, and that rapid and permanent healing occurred in his cases. I had to control the oozing of the cerebral tissue into a cavity and prevent its detachment and escape on account of a complete loss of all its envelopes. I concluded to try a sterilized cup made of heavy gold foil fitted down into the cavity of the cerebrum.

On April 7, two days after the injury, I again had the patient chloroformed, and getting the dimensions of the hole in the cranium I fashioned a cup from the gold foil (which had been sterilized by immersion in a 5 per cent. solution of carbolic acid and then washed off in a warm sterilized saline solution, 0.5 per cent. solution of sodium chlorid) into the shape of a hollow cone, with the base just big enough to fit closely to the inner rim of the inner table of the cranial wound and with a depth of about 2 centimeters. The plugs were removed from the cerebral cavity, with again considerable escape of brain matter, which was washed out by a gentle stream of the warm sterilized saline solution, and the cup immediately introduced, apex downward. I fastened it in place by pressing the foil into the indentations and irregularities of the rim of the inner table and packed loosely into the cup some iodoformized gauze. I incised and loosened the scalp on either side of the wound so

that I could slide it over and cover in the opening, sutured it, except a small space in the center through which an end of the bit of iodoformized gauze was allowed to project, and dressed it as before.

On April 14 the wound was redressed, the sutures removed, and also the packing of gauze from the cavity of the gold cup. The wound was perfectly aseptic, the cup firmly fixed and in place, and there was no bulging and absolutely no escape of brain matter. A small bit of gauze was again introduced into the cup to give it solidity, and the dressings were reapplied.

On April 27 the wound was again inspected. There had been no suppuration, and the wound was entirely closed except where the bit of gauze projected from the cup. This was removed and the external wound was allowed to come together. In a few days this was entirely and solidly united. The patient was allowed to be up and about. His faculties were all good, locomotion was good, and in short he showed no indication in any way of having lost any function; nor were there any signs of irritation from the cup. I kept him about two weeks employed most of the time about the wards, doing the work of an orderly, that I might observe him and examine the seat of wound. There was absolutely no indication of any trouble or disturbance. He was discharged quite well May 20. The wound was firmly united and there was no pulsation perceptible through the opening in the cranium.

Case 2.—George S., a Hungarian, age 27 years, was brought to the hospital by the ambulance on June 21, 1894. He had been engaged in an altercation with some of his fellow workmen the day before and was struck by a stone thrown by one of them. He was felled to the ground, bled profusely, presumably was unconscious, though this point we could not find out, as we had no interpreter. A local physician was called in who found a comminuted depressed fracture and trephined; possibly he raised some depressed fragments of bone. The scalp wound was sutured and dressed and the patient as soon as practicable sent to the hospital. When admitted the man was not only conscious, but could and did insist upon walking into the receiving room. He was a short, healthy looking fellow. Upon investigation there was found an irregular lacerated wound and a more regular oval wound situated in the right

temporo-parietal region. The oval wound was sutured. The sutures were removed and after careful cleansing and disinfection a further exploration showed an extensive comminuted depressed fracture involving the anterior portion of the temporo-parietal region in the right side and the fracture extending downward and forward involving nearly the whole of the temporal fossa. A trephine wound about a centimeter in diameter through the anterior inferior portion of the parietal bone marked the upper limit of the fracture; below, the bone was in a number of irregular fragments and depressed. The patient was chloroformed, the external wound extended down into the temporal region and after careful retraction of soft tissues, during which hemorrhage was rather free, it was found that two large fragments of the temporal bone were depressed and that under the upper edges of these were a number of sharp small fragments which had been driven through the membranes and imbedded in the cerebrum. After raising the temporal fragments the small fragments were carefully taken out. Considerable hemorrhage followed this and escape of not a little cerebral tissue. It was now seen, after the hemorrhage had been controlled by pressure of iodoformized gauze, that the dura and other membranes had been entirely destroyed at the lower part of the wound near the inferior temporo-parietal junction and that there was a persisting oozing of brain matter. It was quite impossible to bring the dura together throughout the whole area, the fragments of bones were irreparably comminuted and soiled. It was determined, therefore, to supply the place of the dura with gold foil. Accordingly a rectangular piece having been sterilized in carbolic solution (5 per cent.) and washed off in warm sterilized saline solution, the brain matter was washed off with a gentle stream of hot saline solution, together with blood and detritus, and an area of 2 c. by 1 c. which was entirely destitute of any membranous covering was covered in by the gold foil, placed under the border of the surrounding dura, and held down by the pressure of the dura and the large fragments of the bones below. The scalp was immediately sutured, stout catgut drain was introduced at the more depressed part of the wound, and the ordinary iodoformized dressing applied. The wound healed with one change of dressings and the man was discharged quite well and appar-

ently in first rate condition in every respect, July 7, sixteen days after the operation.

Case 3.- George E., 20 years of age, Pennsylvanian by birth, was run down by a train of coal cars on the evening of Feb. 19, 1895. He was picked up and brought to the hospital about one hour and a half after the accident. The young man was in a wretchedly low condition when he arrived. He was unconscious, had scarcely any perceptible pulse, extremely pale and relaxed, and covered with dirt, soot and coal dust. Examination showed a complete crush of the left leg to just below the knee joint; the right foot also comminuted and the tissues involved up to the lower third of the leg. There was also a wound on the left side of the head about 3 centimeters above the supra-orbital ridge, back of the edge of the hair at the forehead, and about 6 centimeters from the middle line; this was a fairly clean cut wound, running in a slightly curved line backward in a general way parallel with the middle line. The left parietal bone was fractured so that the fracture was almost linear. Running backward, it corresponded almost with the area of the external wound. The fracture was about 6 centimeters in length. There was considerable oozing of blood and cerebral tissue. The patient's condition seemed hopeless. The ambulance surgeon had already applied an Esmarch's tourniquet to either limb as near the crushed tissues as possible. The limbs and head were now carefully washed, shaved and disinfected and an aseptic dressing applied. He was hurried to bed and surrounded with hot water bags, and stimulated actively by strychnia and digitalis hypodermatically. He was very restless and required large doses of morphia to quiet him. The next morning (February 20) he was conscious, but dull; his general condition had so far improved that he was etherized and both his lower extremities were amputated. The left one through the condyles of the femur and the right through the lower third of the leg. The depressed parietal bone was also elevated, the cerebral tissue and blood carefully washed away and the scalp sutured. The patient stood these three major operations remarkably well. He began at once to improve, the wounds all did well, the head wound especially. He was very drowsy for several days, but could be aroused and could answer questions.

His mental state improved daily and aside from some drowsiness and occasional periods of irritability and restlessness there was no cerebral manifestation of evil, until March 3, twelve days after the operation. During the night of March 3 he had a violent convulsion, epileptiform in character. The wound of his head was entirely healed at this time and there had been no suppuration. There seemed to be no depression at the seat of fracture and there was no abnormal tenderness. He had no further disturbance until the night of the 7th when he again had a convulsion. On the 8th he had frequent convulsions; toward evening and during the night the convulsive attacks became almost continuous and the patient fell into a very weak comatose condition. Careful observation showed that the convulsion began by turning the face to the right, then twitching of the muscles of the face, followed by movements of the right hand and fingers, it then became general. His condition on March 9 was very low, but I determined that there was something remaining at the seat of the fracture which was still an irritant. Under chloroform the scalp was incised along the cicatrix, the flaps turned back and a 1½ centimeter trephine applied at the posterior extremity of the fracture in the parietal bone. After the button was removed by a chisel and a strong steel elevator the fractured bones (which were seemingly not depressed) were elevated and held up by an assistant. There was pretty free hemorrhage which required hot saline solution and pressure with sterilized gauze to control. The seat of operation was so near the longitudinal sinus I was constantly afraid I should wound it. Luckily this did not happen however. When hemorrhage had been controlled it was seen at once that a detached fragment of the inner table had been driven down into the frontal lobe of the cerebrum and lay imbedded in the softened brain tissue. The dura was entirely destroyed for a space of about 2x3 centimeters, and there was a pretty large escape of brain matter. After all the softened tissue, shreds, etc., had been removed and the offending piece of bone taken out, a pretty large cavity was left in the anterior lobe of the cerebrum near the middle line. Indeed the process of the dura which separates the two hemispheres in the longitudinal fissure was laid bare from its cerebral side on the left. This cavity seemed

about 2 c. deep, about 1.5 c. wide and about the same length; The whole of this superficial area could not be covered by the dura. A piece of gold foil cut large enough to cover in this space, and prepared as in Case 2, was laid over this cavity and the dura mater sutured and drawn about the foil as much as possible to hold it in place. The large fragment of bone was replaced, but the trephine button was left out, scalp sutured, catgut drain introduced and wound dressed as usual. The patient was pretty low after the operation (the 9th). He had a slight convulsion during the evening. After this there was no further trouble. He had no other convulsion, the wound healed rapidly. There was no paralysis except perhaps a slight facial paralysis which soon disappeared. The mental state was very dull for about a week. He would answer questions intelligently, but slowly and was drowsy. His pupils were dilated for more than a week. After this he steadily improved, his usual mental state returned, and he was discharged March 28 quite well.

This case, besides illustrating the usefulness of gold foil, shows to a marked degree the amazing vitality of a human being and the tolerance of multiple synchronous major operations if great care be used to prevent loss of blood.

DISCUSSION.

DR. WM. T. DALBY—The paper of Dr. Estes, read by the Secretary, is an exceedingly interesting one. It opens up a new field in brain surgery, particularly in that character of cases where there is great destruction of bone tissue. Since the author of the paper is not here to defend any points that might be brought out in the discussion, I will say nothing further.

DR. HENRY W. COE—I am sorry the author of the paper is not here because I would like to ask him some questions. The subject is extremely interesting to us. I have seen an operation done for epilepsy in this city (Chicago) in which a plate of platinum was used. The old trephine wound opened up in which there were extensive adhesions, and the cavity was filled with fibrinous material, intimately adherent to the dura. The operator, Dr. Morehead, dissected out the new tissue and put in a piece of platinum. The patient was poor or he might have inserted a piece of gold. The operation was extradural

although he went through the dura mater. I am reminded in this connection that Keen in his work on diseases of the nervous system, which has just been published, refers to the fact, which is contrary to the generally accepted idea, that under present methods the opening of the dura is not a serious undertaking and is not accompanied with very much danger. I telephoned since luncheon to find out how this case was getting along and ran across another in which the operator had used a piece of gutta percha. This operation was also extradural. It was done about twelve days ago. I do not remember the name of the operator. In both of the cases the wounds healed readily and up to date there has been no evidence of the presence of a foreign body. I do not know exactly how thick the piece of platinum was, but it was probably one line in thickness. In the cases which Dr. Estes reports, I understand the gold foil is inside the dura mater, and I for one will watch the history of them with a good deal of interest. In these cases we have a foreign body pressing on the brain, and it will be interesting to know the outcome of them.

DR. H. HATCH—I regret that I was not present to hear the whole of the paper that has been read. Are we to understand that Dr. Estes maintains that by introducing gold foil inside the dura mater it will prevent adhesions and consequently the after effects in the way of epilepsy?

DR. KELLY—I believe that is the idea.

DR. HATCH—A professional friend of mine had a case of epileptic convulsions following an injury upon which he operated. The adhesions in this case were dense and firm. He dissected away the adhesions and proceeded in the manner laid down by Dr. Estes, not applying gold foil. The convulsions did not recur for two or three months, but when they came on again they were as bad as before the operation. It is well to report the unfavorable as well as the favorable cases.

THE MECHANISM AND DIAGNOSIS OF TRAUMATIC CEREBRAL LESIONS.

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In this paper I wish to review the mechanism by which traumatic lesions in the brain are produced, and the means by which an exact diagnosis of the seat of the lesions must be made.

Until recently it has been considered justifiable for the surgeon, after having made a gross diagnosis of fracture of the base, "compression" or "concussion," to stand by and see his patient die, or become the subject of epilepsy, insanity or permanent paralysis. Medical literature is filled with cases illustrating the natural results of these injuries, following the "expectant" treatment. From them, one quickly learns how slowly and imperfectly nature repairs the lesions, and how far reaching are the after effects. Some have questioned whether a cerebral injnry is ever completely recovered from.[3] The evidence is now complete, that various forms of insanity, in many cases, originate in and are directly caused by a neglected injury to the brain. This has long been known of epilepsy and various motor and sensory disturbances. In a recent paper read before our Jackson County Medical Society, I reported in detail ten cases of

cerebral injury, showing forms of mental derangement, from simple loss of memory, to persistent irritability of temper, melancholia, delusional and moral insanity and mania, all the direct result of intracranial injury. Most of these were due to old injuries; some submitted to operation and were relieved, others not. But the recital of the cases was not so much for the purpose of calling attention to the results of late treatment, as to the fact that symptoms of such nature had resulted from an unrepaired intracranial injury. To show how infrequent interference is in these cases, I need only quote the statistics recently furnished by one of the best hospitals in the country.[1] In six years, 308 cases of severe head injury were treated with 115 deaths. In twenty cases fragments of bone were removed and in 24 cases only was trephining done. Eighty-two of the cases were characterized as "Fracture of the Base," of which 60 died. Three of the 82 were trephined, two without success and the third was successful in opening into the seat of the hemorrhage, but the vessel was not secured and death followed in twenty-one hours. No report is made as to the condition of those who survived. Thirty-two cases, excluding the gunshot cases, came to autopsy and showed extradural hemorrhages in thirteen, which the report comments on as "a larger proportion, of localized extradural hemorrhages than is generally appreciated."

I can not dwell on the necessity of repairing at once and as completely as possible, the effect of an injury to the brain or its coverings. All will I think, acknowledge the desirability but question the ability to locate most of the lesions when recent, and even if

located, to relieve them. Apparently little effort has ever been made to get at the basal extradural hemorrhages which comprise such a large proportion of the fatal cases. These extravasations remain fluid for hours after an injury, and the suggestion is directly at hand, that the pressure could be taken off a well localized mass by a carefully directed aspirating trocar or needle introduced directly through the brain mass, as well as by an opening at edge of base and separating the dura. It is not my purpose however to enter into treatment.

It must be acknowledged that the exact diagnosis of recent intracranial lesions often presents a most complex problem. The real difficulty does not lie in the interpretation of symptoms, for these are often complete and conclusive in their indications, but rather in the lack of data furnished by an unconscious patient. There are facts however which may be obtained under the most disadvantageous circumstances, and these are sufficient in the majority of cases to lead to a correct diagnosis. It is always to be kept in mind that the absence of symptoms is as significant and possesses as much logical force as their presence. Also that the brain is not unlimited, hence a localization by exclusion in the absence of a direct diagnosis, is permissible.

Let us take first the mechanism by which the lesions are produced, and then the resulting symptoms with special reference to their localizing value. The first effect of a blow is received by the scalp, which may be cut, bruised, lacerated, or when protected, may show no evidence whatever of a serious lesion beneath. It is always to be carefully examined for such evi-

dences as it may furnish. It is the most direct avenue for infection, leading to important and often disastrous secondary changes, and on that account is worthy the most painstaking care of the surgeon.

The effect upon the cranium is determined by the force of the blow, and the curve, thickness and density of the bone. The character of the injury can often be inferred from the nature of the accident. In a general way it may be said that it is dependent on the velocity and concentration of the force. When the velocity is great, and the force is concentrated, the effect is most marked at the seat of impact, as when a bullet strikes the skull. But when the force is disseminated and of slow velocity the effect is generally most marked elsewhere, as when a man receives a blow from a sand bag.

With the exception of the fracture at point of impact, which may be depressed, cranial fractures are linear and almost invariably run toward the base, following the curve of the shortest radius and in the line of least resistance. That this is not invariably true is due to the fact that in some instances the force is so applied as to force the fracture to follow a long curve, as in compression of the skull from the sides. The so-called fractures by *contre coup* are no longer to be considered possible.[2] The only way in which the skull can be injured on the opposite side, is by injury against a resistance which is really equal to a second direct blow. This applies to the brain also, which is often injured by being bruised through its impact against the skull.

Most of the linear fractures have no importance in themselves, and it is unfortunate that modern surgery

still classifies head injuries under "fracture of the vault," "fracture of the base" etc., as though these were important. The close association of such structures as the facial nerves, the middle meningeal artery and branches and the sinuses makes it necessary to estimate as closely as possible their direction and extent. It should also be borne in mind that extensive fractures can not be received without grave injury resulting to the cranial contents as a result of the same force which produced them. But a depressed bone in itself does no harm, were it not for the injury it inflicts on the parts beneath. It is the brain and its nerves which are of importance, and which must be considered from first to last. This has been formulated in the statement that "all cases of head injury should be estimated primarily with reference to the amount of damage which the cranial contents have received, and secondarily with reference to their becoming involved."[3]

The brain is a soft solid, permeated with tougher blood vessels, and poised on a water bed over a very rough and irregular base. This water bed of cerebro-spinal fluid surrounds the hemispheres and is continuous with that in the spinal cord. At the base of the brain, it varies much in depth, owing to the irregularities forming the so-called lakes. Inside the brain the ventricles are filled with the same fluid, and each blood vessel in the brain is suspended in a double lymph space also filled with the same fluid. Between the muscularis and adventitia of all isolated arteries is the adventitial lymph space of Robin, and outside of this, between it and the limiting membranes is the perivascular space—or space of His. Any increase in

the size of the vessels takes place at the expense of the fluid in one or both of these spaces—and as the skull is a closed box, it is conversely true that anything which displaces this perivascular fluid, must be attended by an increase in the size of the vessels, or rupture. Moreover not only the nerves but the nerve cells themselves, lie in spaces filled with the same fluid which connect with the perivascular spaces.

The fluid on the outside of the brain is directly continuous with that in the spinal cord, but that of the subarachnoid and intra-ventricular spaces is only communicable through the small foramen of Magendie at the fourth ventricle, the so-called cerebro-spinal opening. It is this cerebro-spinal fluid which plays the most important rôle in traumatic intracranial lesions.

The other factor is the elasticity of the skull as a whole. This varies greatly from infancy to old age, but must be most marked in the young adult skull with firmly united sutures and a large amount of animal matter in the bones. If dropped from a height on the floor such a skull will rebound like a ball. The interosseous membranes prevent the infant's skull from having the solidity necessary for such a rebound, and the brittle bones of old age break too easily, so that the problem varies somewhat at the extremes of life. It has been shown by Felizet[4] that the adult skull, when struck a moderate blow, yields under it, forming what he calls the "cone of depression." It is similar to what occurs in a billiard ball or a bell when struck. The blow compresses the billiard ball in one diameter and it lengthens in the transverse. As it rebounds the long diameter becomes the short one and the short one lengthens, and this continues, the alter-

ations becoming continually more feeble until the force is spent. This causes in a bell what we call its tone, which is long drawn out because its edge is accurately round and hangs free so that nothing interferes with the vibrations. But in the skull the effect is necessarily of short duration, the vibrations being quickly interrupted by its buttresses, irregularities and attachments.

Under these premises, what happens from a blow on the head? Let us say for simplicity, that it is not sufficient to produce a penetrating wound. Under the blow the skull is momentarily depressed—lengthens in the transverse diameter, and rebounds, becoming elongated in the diameter in which the blow is received. The bone may or may not be fractured. If depressed beyond a certain point it can not rebound and we have a depressed fracture. The fissure in the bone may involve vessels or nerves in close connection with it, leading to immediate hemorrhage or paralysis. The sudden depression of the skull drives the cerebro-spinal fluid forcibly from under it, and superficially it must spread laterally into the areas where the diameters are elongated—and what is not thus accommodated is forced into the perivascular lymph spaces, or forcibly injected into the spinal column.[5] This explains how we can have a lesion of the spinal cord from a blow on the head. The quick rebounding of the skull tends to leave a vacuum at the four diameters where the maximum of motion has been, *i. e.*, at the point of the blow, diagonally opposite and at the two points at the extreme of the transverse diameters. Now the impetus given to the cerebro-spinal fluid is such as to send it out of the

way, and the reflux of the fluid is relatively slow, so that we have the vessels left without support, and they give way under the strain at the four points mentioned. Thus are accounted for the extradural and sub-dural hemorrhages.

That which happens in the brain is exactly analogous to that which happens in the cerebro-spinal fluid lying outside. The impetus of the blow received on the vault tends to drive the fluid from the larger ventricles into the smaller, from which there is no escape except through the small opening of Magendie. All the perivascular lymph spaces receive the same impetus, and momentarily the blood vessels and nerves are unsupported; thus occur numerous minute intercerebral hemorrhages into the nerve sheaths, which are found as constant factors in cerebral injuries. The sudden intense distension of the fourth ventricle often results in rupture of its walls. In this way is accounted for the well-known glycosuria which so often follows cranial injuries; also cases of immediate death from laceration of the vagi at their roots. The rush of the fluid through the foramen of Magendie into the spinal cord is sufficient to irritate and often to lacerate the restiform bodies in the bulb. It has been experimentally found that mechanical irritation of these bodies, produces a reflex anemia of the brain, attended with all the symptoms of the so-called "concussion." Also the evidence of many autopsies points to them as the seat of the fatal lesion, so that the conclusion is irresistible that the opisthotonus, spasms, rigidity and other symptoms joined together under the name of concussion, find their explanation in the irritation

of the restiform bodies by the cerebro-spinal fluid as it is violently injected into the spine.[6]

The brain mass itself, deprived of the protection of the cerebro-spinal fluid, is lacerated at the site of the blow, and on the opposite side through its own impetus against the bone. When the impulse is downward, it is found that the resulting injury against the jagged projections in the base are not more marked than against the smooth and rounded vault. These act like the elastic falx and tentorium which are stretched like sails in different planes between the cerebral masses, and take up a large portion of the force, directly preventing the impinging of the proximal half of the brain upon the distal portion and against the opposite bony wall. It is interesting to note that the tentorium is ossified in some animals, whose brains are built on the fore and aft plan, *e. g.*, cats.

All possible primary lesions thus consist of, 1, the fractures in the skull and rupture of nerves or arteries and sinuses in close connection with it, with their resulting hemorrhage; 2, lacerations of the cerebrum, basal ganglia and the underlying nerves; 3, hemorrhages into the brain substance, nerve sheaths and basal ganglia and edema of tissue adjacent to those parts pressed upon. Of these three sets of lesions, localized hemorrhages upon the surface are in the majority of cases the cause of death or permanent injury, and statistics show that a majority of them can be reached if located. The secondary lesions comprise unorganised blood clots, cysts, hematoidin deposits, collections of colloid bodies, cicatrices, miliary scleroses, adhesions, varicose veins, and last but

not least, the secondary infections, pyogenic and sarcomatous.

I wish to-day to consider the symptoms from primary lesions only, *i. e.*, the fractures, lacerations and hemorrhages which we see in a recent case. I wish to repeat that the linear fractures are of little importance beyond indicating the possible source of other lesions.

The inference to be drawn from immediate facial paralysis, hemorrhage from the ear and a true subconjunctival hemorrhage are too obvious to be repeated. The depressed fractures interfere with or suppress the functions of the portion of the cortex pressed upon and demand immediate attention, not with a view to restoring the skull, but wholly with reference to the underlying brain. There is no such thing as a depressed fracture without symptoms, unless you suppose that there is a portion of a man's brain without function. It may take time and study to demonstrate them, however. The effect of the lacerations and hemorrhages depend upon their situation and extent. A laceration may cause immediate and total abolition of function at the site, through the severing of the nerve connections of the part. The phenomena resulting from a hemorrhage, and the mechanism by which it acts, are best seen in cases where a small vessel is ruptured and a considerable time occupied in the development of symptoms. Slight at first, it irritates the abutting cells and the normal action of these cells is manifested peripherrally in response to the stimulation. If into the motor area, involuntary twitchings or spasms of a muscle or group of muscles may result. As the hem-

orrhage increases in amount, it presses upon the cells, and driving out the intercerebral fluid prevents the circulation of blood and lymph through the part pressed upon. From the irregularities of pressure upon the vessels, a halo of edematous tissue invariably forms around the compressed area. This area is bloodless, therefore without function, and this loss is manifested peripherally. It is not to be seen by looking at the compressed area. The resulting symptoms comprise all possible motor and sensory disturbances, mental and moral aberrations according to the parts pressed upon. A good example of the varying effects of pressure from hemorrhage is seen in the eye symptoms resulting from rupture of the middle meningeal artery.[7] At the outset the eyes twitch toward the side opposite the lesion, and remain there with contracted pupils and often constant nystagmus until the pressure is sufficient to cause a paralytic lesion when the eyes roll toward the side of the lesion, the pupil on the side of the lesion dilates and the paralysis is complete. The importance of a hemorrhage depends upon the nature of the tissues pressed upon and the degree of pressure. A mass the size of a pea, suddenly extravasated into the medulla may be immediately fatal, while a pint of blood may be slowly and harmlessly spread over a hemisphere with few recognizable symptoms.

A depressed fracture acts like a localized hemorrhage in the cortex and is equivalent to the presence of a foreign body in the cranial cavity.[8] From it the general cerebro-spinal pressure rapidly rises and gradually falls, leaving the depressed area anemic in the midst of an area of edematous tissue which rapidly forms.

From the local pressure there results a general difference in the temperature of the sides of the body.[8] When the compression is slight, the opposite half of

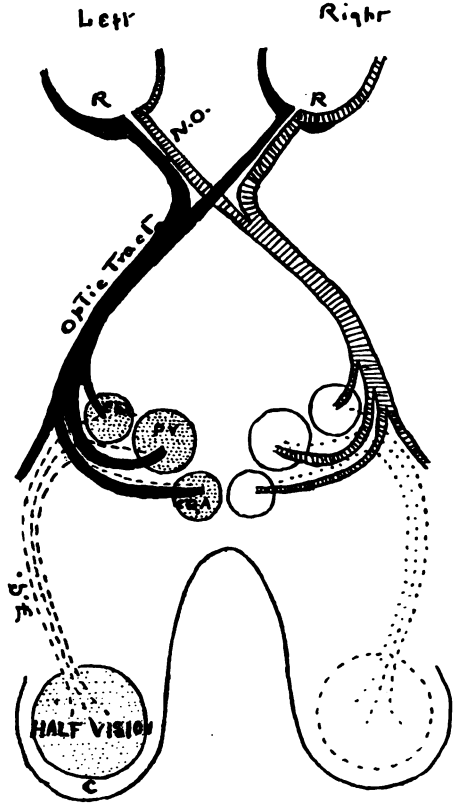

FIG. 1.—Showing course of visual fibers. R, retina; N O, optic nerve; P V, pulvinar; C G L, corpus geniculatum laterale; C Q A, corpus quadrigeminum anterius; F G, fibers of Gratiolet; C, cuneus.

the body (*i. e.* the paralyzed half) shows an axillary temperature distinctly higher than that of the other side. Whereas, when the compression is considerable,

the reverse is the case, and the opposite side has a lower temperature than that on the same side of the lesion. It has been suggested as a working hypothesis to account for these facts, that a small pressure produces an irritative lesion of the inhibitory mechanism of the vaso-motor center supplying the opposite side of the body, and so a dilatation of the cutaneous vessels is produced, causing a rise in the surface temperature. A greater pressure produces a paralysis of the inhibitory mechanism, so that the vaso-motor center acts without restraint, constricts the vessels, and leads to a fall in temperature. This point has not yet been fully worked out, but may be of considerable importance when fully developed.

A local compression of the cortex also causes characteristic changes in the pupil.[8] If the compression is small, an irritative lesion apparently results and at the same time, as the temperature of the opposite side of the body becomes elevated, the pupil of the same side contracts and reacts poorly to light. When the compression is greater (the opposite temperature falls) the pupil of the same side dilates, while the opposite pupil contracts.

When the pressure becomes great enough to considerably affect both hemispheres, the opposite pupil will also dilate.[10] Dilatation of the pupil primarily on the same side as the lesion was described thirty years ago by Mr. Hutchinson,[9] and has since been known by his name, and the "Hutchinson pupil" has become familiar as a sign of hemorrhage from the middle meningeal artery. The phenomenon was supposed to be due, by Mr. Hutchinson, to the gravitation of the blood toward the base and its pressure upon the thir

nerve. But recent experiments have developed that pressure at that point is not necessary to produce the phenomenon. Furthermore it would be difficult to explain on this hypothesis, as Mr. Dean points, out how it is that only the fibers of the third which go to the iris are paralyzed, while the other muscular branches are not. It would appear that any cortical pressure, at least in this region, is sufficient to produce the dilated pupil.

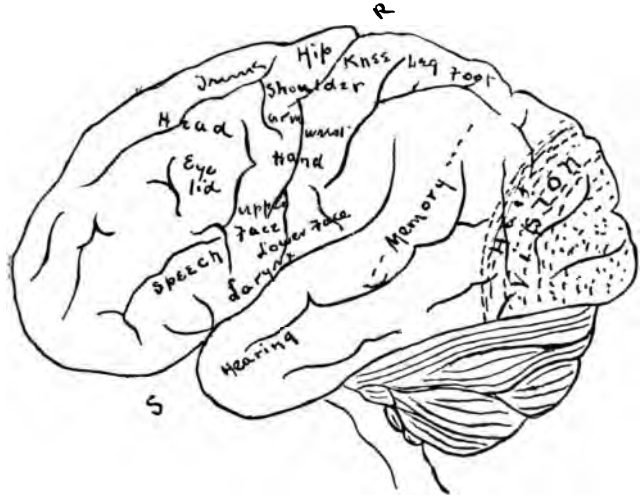

FIG. 2.—Diagram showing external surface of left hemisphere. R, Rolando; S, Sylvius.

Beside the alteration of the pupil referred to, which is really a paralysis of the muscular fibers of the iris, we may have as eye symptoms: 1, paralysis (and spasms) of the ocular muscles; 2, alteration in the field of vision; 3, incoördination of the parts concerned in the act of vision in each eye singly. In order to understand the ocular symptoms it is necessary to

know a little of the central visual apparatus. The movements of the external muscles of the eye are controlled by the third, fourth and sixth nerves, and this motor mechanism "is finely bilateral but the sensory mechanism is badly unilateral," [11] and hence of much greater localizing value. This unilateral disposition affects not each eye singly, but the lateral halves of both eyes. Taking first the muscular apparatus, and the third, fourth and sixth nerves: If we turn our eyes to the right or left it is done by the double synchronous action of the internal rectus of one eye and the external of the other. This is the physiologic process known as conjugate deviation.

Definite relations do not appear to exist between any one part of the motor area and the ocular movements. Irritation of the whole cortex as well as the visual area occasion ocular movements toward the opposite side (conjugate deviation) and these movements are greater, the farther the irritation is removed from the macular region of the visual area. The fibers from their cortical nuclei are collected and rearranged and coördinated at the top of the pons Varolii and pass out thence together, coming into close relations again in the neighborhood of the cavernous sinus and the sphenoidal fissure.[12] The only portion of the cortex which seems to have a definite ratio to any of the muscles about the eye is a portion of the anterior central convolutions in front of the face area (Fig. 2). Pressure at this point causes a falling of the upper lid (levator palpebræ superioris) on the opposite side from the lesion. The connection of the basal motor ganglia with the cortex of the cerebrum is as yet uncertain, but the fibers pass down in the anterior

part of the internal capsule and through the pyramidal tract to the neighborhood of the third nerve where they cross. As the internal recti are supplied by the third and the external by the sixth pair, a limited lesion in the pons may result in separating conjugate movements into its elements.[13]

A considerable lesion in the pons will produce a wide spread ocular palsy.[12] And the farther away from the pons the lesion is, either cortically or peripherally, the more limited will the paralysis be. Lesions above

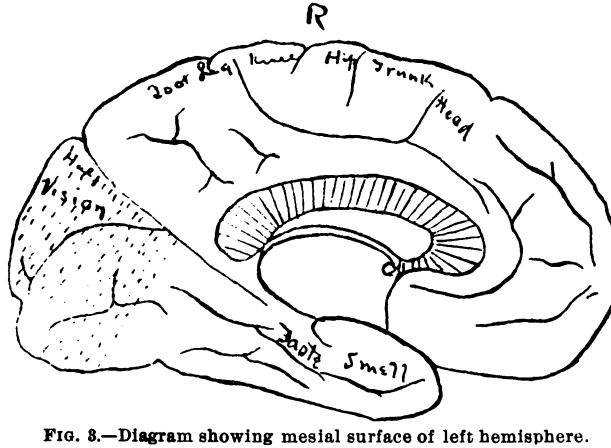

FIG. 8.—Diagram showing mesial surface of left hemisphere.

the pons and in the cortex produce physiologic paralysis *i. e.* of associated movements of both eyes. Lesions below the pons will paralyze single nerves and their corresponding muscles. Excepting that a lesion at the cavernous sinus and sphenoidal fissure may take in a group of nerves but affecting one eye only. And this paralysis will be crossed with any body paralysis which may be present. To summarize: Conjugate deviation of the eyes, accompanied by twitch-

ing, spasms or other irritative symptoms, is indicative of a lesion in the cortex on the opposite side to the deviation. Conjugate deviation accompanied by paralytic symptoms, dilatation of the pupil, indicates a lesion on the side toward which they deviate. Irregular or partial conjugate deviations and wide spread palsies indicate a lesion in the pons. Monocular palsy may mean a lesion anywhere between the eye and the basal nucleus, but if more than one nerve is implicated, the lesion may be near the sphenoidal fissure, or in the cavernous sinus. Ptosis results from paralysis of the third in its course or pressure on the anterior central convolution.

In the sensory act of vision, two orders of central apparatus are involved, whose relations are best understood from the diagram (Fig. 1). The optic nerve divides into three parts which go to the pulvinar, the anterior corpora quadrigemina and the lateral corpora geniculata. These are usually spoken of as the primary visual centers. These are in turn directly connected with the cortex of the occipital region of the cerebrum called the secondary or half vision centers (Fig. 1 c). As was said in speaking of the motor mechanism, the sensory mechanism is "badly unilateral," and is connected with, not each retina singly, but the corresponding halves of both retinæ. This I believe is made clear in the diagram.

The same distinction is to be found here as elsewhere between irritative and paralytic lesions. If the lesion in the visual cortex is slight, the irritation is manifested in subjective sensations of flashes of light, of colored fire, etc., and may be referred to the opposite eye, or may be common to both eyes. A lesion

large enough to suppress the function of the cortex is manifested by a loss of vision in the lateral halves of both retinæ on the side of the lesion. This symptom

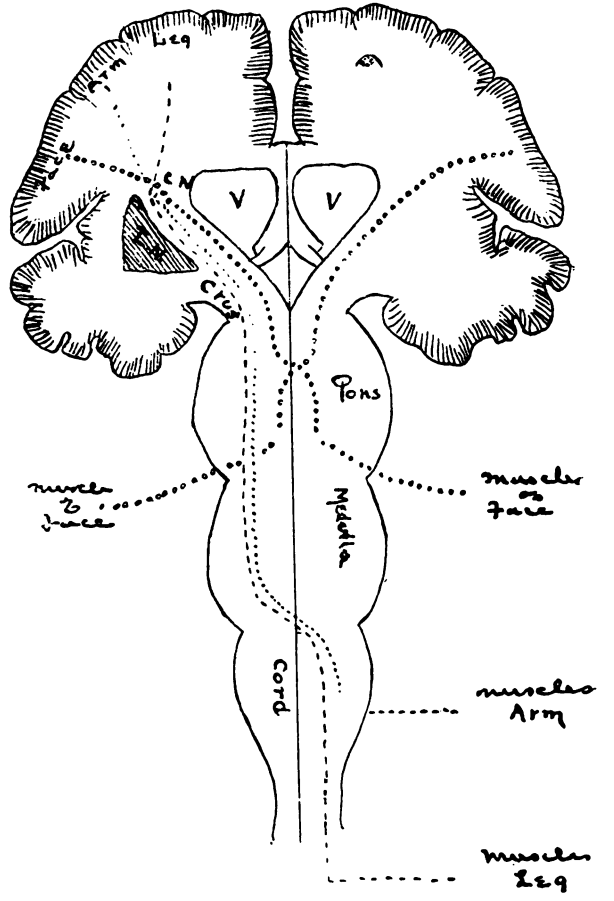

FIG. 4.—Showing course of fibers from motor tracts. V, lateral ventricles; L N, lenticular nucleus; C N, caudate nucleus. Between them, the internal capsule.

is known as homonymous hemianopsia. It may be caused by a lesion anywhere between the chiasm and the cortical visual center, but practically for our purpose it is necessary to consider only the cortex lesion, as any hemorrhage large enough to interrupt the conduction in the optic tract would be otherwise immediately fatal. Wilbrand's test is of use here in case of doubt. A fine pencil of light is directed on to the paralyzed side of the retina: if the pupil contracts, the lesion is cortical: if it does not, it is in the optic tract. Central vision in cases of hemianopsia is usually unimpaired, the macular center being apparently double and common to both eyes.

In rare cases the lesion may be so placed as to involve a portion of the macular center, thus causing incoördination of the visual images of one eye and giving rise to monocular diplopia. The inference from this symptom is immediate and direct as to the implication of the macular center. The sensory eye symptoms must be looked for. It should be remembered that a paralysis of the left side of both retinæ means that right half of the field of vision is involved.

Leaving the eye we come to the motor apparatus, of which the centers have been well differentiated. They are grouped around the fissure of Rolando and can be best shown quickly by a diagram (Figs. 2 and 3). The location of the leg, arm and face centers, eyelid, speech, hearing and smell are accurate, and any paralysis or spasm of cortical origin will appear on the opposite half of the body. The fibers from the cortex are collected, pass through the internal capsule into the crura cerebri, thence into the pons where the facial portion crosses to the opposite side (Fig. 4). The

arm and leg fibers pass on into the medulla where they cross over. Somewhere between the cortex and the crus cerebri, probably in the internal capsule, the sensory fibers join the motor, but their centers are as yet poorly worked out. A lesion in this part of the cortex is often purely motor. Lower down the lesion must involve sensation.

When the lesion is above the crus cerebri, we have the ordinary crossed paralysis of the face, arm and leg; but from the crus down we may have one or another of the alternate paralyses combined with a lesion of the cranial nerves in most instances.[12] There may be 1, paralysis of the face, arm and leg on the opposite side to the lesion and of the muscles supplied by the third nerve on the same side; 2, paralysis of arm and leg on the opposite and face on the same side; 3, paralysis of the arm and leg on the opposite and of the muscles supplied by the seventh and sixth on same side; 4, paralysis of the arm and leg on the opposite side and the face on both sides; 5, paralysis of face, arm and leg on the opposite side, and anesthesia (from paralysis of the fifth) on the same side of the face; 6, paralysis of the arm and leg on the opposite, and the tongue on the same side. It is important to keep in mind the significance of the cross paralyses. What has been said of paralyses applies equally well to spasms.

So much for connected facts regarding the possible seat of lesions. There remain several disconnected facts, which are often of great significance. The first of these is the hyperpyrexia often attending a hemorrhage into the pons. The screaming fits which result from irritation of the posterior portion (testes)

of the corpora quadrigemina and the incoördination of movements following pressure upon anterior portion of the quadrigemina are worthy of note. Pressure upon the middle lobe of the cerebellum also produces incoördination especially in the legs. Vomiting which is so common in head injuries has some localizing value. In the vast majority of cases it is a pure reflex caused by pressure or irritation of the membranes of the brain. It may be also caused by direct implication of the vomiting center in the medulla from which the vomiting is usually active and persistent. In ordinary cases it is to be taken as indicative of a surface lesion, and its frequency may be roughly used in connection with other symptoms in estimating the degree of intracranial pressure.

Similarly manifestations of pain point to a surface lesion as was pointed out by Mr. Hilton many years ago. But all manifestations of pain are apt to be suppressed quickly by the rise in the intracranial pressure. It is a valuable localizing symptom however when present. The retraction of the head and neck, associated with incoördinated movements, mechanical yawning, low temperature, slow and feeble pulse and especially jerky uneven feeble respiration are characteristic of hemorrhages into the cerebellar fossa.

Unconsciousness commonly follows severe head injuries immediately. If it does not pass off in a short time it means an increased intracranial pressure, probably from hemorrhage. If it passes off promptly and after a short lucid interval the patient becomes again unconscious, the diagnosis of hemorrhage is certain. Associated with paralytic symptoms and dilated immobile pupils, it is indicative of excessive intra-

cranial pressure, probably from hemorrhage, and demands immediate operation, if only to relieve an edematous area in the absence of definite localizing symptoms.

In conclusion it may be said that the cerebral centers are not to be considered as sharply defined in their relation to the body but as spots of maximal relation whose functions merge into and are directly connected with those of other centers. The cerebral centers are not related to the body like the keys of a piano to its strings, but rather as the keys of an organ which by its stops may bring forth many combinations in harmony with the pipe which corresponds to a given key.

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DISCUSSION.

DR. JAY—I do not know of any paper that could be more interesting and more positively demonstrated. The paper deals with positive facts and can be demonstrated, and the thing to do is to take up these facts and to become so familiar with them that we can make the diagnosis and the consequent treatment according to the laws laid down by the paper. That is all I can say about it. It can not be discussed.

THE PRESIDENT—The paper certainly is very exhaustive and very instructive.

DR. GRISWOLD—The applications to be made in practice of this paper are of extreme importance. Going back as far as 1858, I recall the first case that I had in injury of the brain that might have been saved if I had known as much about brain injuries as the doctor does.

A man had received a blow on the temple, just over the frontal bone, near the coronal suture, from a wine bottle. He was a hack driver. He drove sixteen miles that evening, stayed at home, drove back the next day, and the next night could not drive home. He was delirious, had considerable fever and a good deal of pain. He was brought home and I was called to him in the night. There was a little contusion, no depression, and the man was sick, and kept sick till he died two weeks afterward. He had some diarrhea during the disease, there was no paralysis, and the effort was made to say that he had typhoid fever; I stopped that. When I made the post-mortem examination I found the inner table of the skull had been fractured which ran across the meningeal artery, and had produced an extradural affection between the skull and dura mater, which led down over the root of the eye. General meningitis spread from that point and death resulted. If we had appreciated the situation and trephined, we might have saved the man.

Some twenty years ago I was called to a consultation in regard to a boy who had received a blow transversely across the skull by the edge of a board. The boy was struck down, but there was no wound on the scalp and no apparent injury. He did not, however, seem to be quite able to get up. He had a doctor attending him, and I dare say it was four days before I was called to see him. I could not see any special marks of brain injury. The eyes did not work exactly together. He had no pain. Three or four days later I was disposed to make a crucial incision at the seat of the blow and was permitted to do so, and found a depressed fracture, with considerable pressure on the brain. No other symptoms of brain depression, but there was a depressed fracture and several pieces of the bone loose. I took out the loose pieces and elevated the remainder and the boy got well and is well now. He was then 12 years of age; he is now married and has a family. Never had signs of epilepsy or anything of the kind. I always thought if I had

not done that operation he would have been an epileptic.

Three years ago last Christmas I was called in consultation to another case on a man who had been down in a shaft forty feet and a barrel was let down, striking him on the side of the head, smashing his skull and producing quite a wound. The doctor who was called to him on Friday—Christmas was on Sunday that year—did not do much, as he was a young doctor and did not know very much about such things. There was not much paralysis. The wound was over the frontal convolutions, down rather in front of the fissure of Rolando, but involved the speech center. I was called to him Sunday morning and found there was an excessive congestion over all that side of the scalp. I took out probably to the amount of 2½ square inches of skull, all smashed up. The dura was torn open, the speech center was involved, so that a great deal of brain substance came out during the operation. I supposed he would be seriously affected in speech. He got well, and strange to say, he can talk now tolerably well. He lives in Colorado, near Sterling; his name is Shaw. There is a great deal of wound covering there on the skull, and the skull is affected. If he speaks and sneezes you can see the brain bulging out. He never will be worth anything for business, but still, if life is worth living, he has got it.

The doctor's demonstration specializes a great deal more than was necessary in these cases; these did not require so much specialization, except perhaps the first. In 1858, if I had known a little more about the brain, I would probably have trephined.

Dr. Henry Hatch, of Quincy, Ill.—In connection with injuries to the brain I wish to speak about a case that I had about eight months ago, as illustrating that it is not well for us to lose sight of a case after an injury. It was a railroad employe; he had the superior portion of his scalp lacerated from a falling brick, and a lacerated wound a little to the right of the median line. I examined the wound and found no depression of the skull whatever, and supposed he would get along all right by dressing the lacerated wound. It healed without any suppuration or any untoward symptoms, and I supposed the man would get well. About five weeks later pain developed in the region of the wound and it became necessary to open it

up, trephine, and I found the inner table of the skull depressed and fractured, while the outer table showed no marks of depression whatever. After this operation he recovered without any more trouble.

Dr. Henry W. Coe, of Portland, Ore.—The writer of this paper, Dr. Perkins, says that we can remember regarding the centers and diagnosis in these cases if we have some charts handy about the office. I think it would be a good thing after this paper is published, to have this paper in our offices so that it would be convenient for reference when required. It is worked out very carefully, and this subject is somewhat recent. The pathology of injuries of this kind, and the histology of the nervous system is of such a recent date, so far as it has been worked out on any scientific basis, that a paper of this kind is one that this Academy can well be proud of. I am glad to see the doctor note the symptom of pain, and the case just related is in point. We often have injuries of the head in which there is no depression that we can determine, but in which there is a great deal of pain, which continues after the pain from the contusion of the scalp passes away, and I think in all those cases we should explore a portion of the skull. In such cases there is undoubtedly some displacement of the inner table wherein pressure is exerted through the meninges upon the cortical substance beneath. I have seen a case on my way to this meeting, and on which I shall operate on my way home, in which there is practically no depression, at least no depression determined, but there is intolerable pain, following an injury occurring some years ago. No doubt in this case there is some inflammation, following a fracture of the inner table and some inflammation of the dura. In fact, there may not even be an apparent fracture, merely a slight bulging inward of the tabula interna sufficient to produce the lesion. Where there is some pain, there is generally some dural trouble. The doctor referred to hemianopsia following injuries in certain localities, but he did not mention the fact that we sometimes have this condition in case of a sanguineous patient. We sometimes see this in cases where there has been no head injury, and sometimes we think perhaps there has been hemianopsia there, and yet in some cases where this condition exists temporarily, stimulation will relieve the case. The

doctor has no doubt seen a case of this kind but I do not remember hearing it mentioned in the paper. We know that we have that condition of women in labor, where there is a large flow of blood and which perhaps in twenty-four hours passes away, or else passes away quickly under stimulation.

DR. COLE—I feel that Dr. Perkins has placed us under obligation for this remarkably clear elucidation of a very important subject. The study of cerebral topography and cerebral localization and the practical results to be gained from the knowledge of the physiology of the brain and the facts as brought out in the paper, are comparatively recent and are of the utmost importance. Those of us who have practiced a dozen years or more remember with what almost horror we looked upon the prospect of opening the skull. In this day of clean surgery we do it with impunity. We operate for symptoms which a dozen years ago were blind and we can operate with accuracy and we can get positive results. I feel that the Academy owes its thanks to Dr. Perkins for this very able paper.

DR. HATCH—I want to say just a word in line with what Dr. Cole has said, and to go perhaps a little further than the author of the paper has recommended. He said that in simple linear fractures without symptoms of compression, it is as well to pay no attention to them. I believe from experience in quite a number of cases in which I have trephined, that in the majority of cases of simple linear fractures, you will find an infused clot underneath the fracture pressing on the dura, and I believe that the impunity with which we can trephine and enter the skull anywhere on the dome of the skull, has shown us that it is good surgery to explore in every one of those cases. The fact is, in those cases of recovery it is only a week or ten days until they are comparatively as well as they always were. It seems to me good surgery, in absence of other symptoms there than symptoms attending linear fracture, to trephine and find out what you have. I have just got through a case which has recovered which shows that one should not despair in very extensive fractures of the skull. About two months ago a colored man was thrown from a wagon upon the curbstone and fractured a portion of the skull 3½ inches in diameter, lacerating the anterior frontal sinus. The hemorrhage was very exten-

sive; I had him conveyed to the hospital as rapidly as possible and it looked to me as if the case were hopeless. I removed about 3½ inches of the anterior portion of the cranium and caught up the anterior frontal sinus and ligated, and the man is around town to-day apparently as well as ever.

Dr. Peck—I would like to detail one case I had six years ago. It is that of a boy of 14 who was employed in the iron mines to drive mules which brought the cars of ore out from the mine. In reaching in to uncouple the chain links between the cars, his head was caught between the projecting beams on the two cars, and by the impact of the cars going down grade behind and jamming them together, the head was caught in the space between the two beams, which afterward by measurement was found to be 5¼ inches. I saw him within twenty minutes or half an hour, found a depressed fracture of the left parietal bone at its middle portion just above the ear. The depression, which was very plainly made out, consisted of two fragments wedged down on the brain, the soft surface of the meninges. The hematoma covering the field of the pressure was pulsating synchronously with his heart, and it was with a good deal of fear that I made an incision. I feared I would have a troublesome hemorrhage before I could trephine and remove one of the fragments of bone in order to get to where I could control hemorrhage. However, on making the incision there was just one gush of an ounce or so of blood, and no further hemorrhage. It was an absolutely clean operation, the pulsations having been transmitted from the brain substance itself and communicating through the triangular openings above and below the angles of the fracture. It was quite a slow operation, cutting out the first fragments of bone, inasmuch as they were wedged down in the shape that it took a great deal of lifting force to get out the fragments of the bone. The symptoms which the boy presented were a semi-unconsciousness, some vomiting, unequal pupils, symptoms of partial compression. I removed one of these fragments of bone, elevated the other, and that boy never had a rise of temperature above 99.6, and in eight days after the injury was out playing ball. There were three lacerations of the meninges; there was an escape of a teaspoonful or more of cortical substance; there was absolutely no functional trouble; there were no symptoms

following the injury save that he has a depression in which you can lay a finger.

DR. DANIELS—I feel that we are largely indebted to Dr. Perkins for this instructive paper. I rise to differ from Dr. Peck in regard to miscellaneous trephining in linear fractures. I do not quite favor that, but I do believe that age should have very much to do with all operative measures in that direction. I have found in my experience that children or very young people will bear considerable depression or a great number of linear fractures without any bad symptoms at all, while persons of middle age or beyond, having comparatively the same injury, will have very serious results follow. In adults the use of the trephine is almost imperative. I believe that the consideration of age in these cases, so far as I am able to judge from experience of a considerable number, covering perhaps two hundred in the hospital where I am associated, is an essential one.

DR. JAY—We all admit that in young persons you can have a depression of the skull and probably have no spasms and no paralysis, but experience will tell you that in after life they are sure to have them if the depression is left. I have operated on several cases, twelve, fifteen and twenty years ago, and for years afterward there would be no unfavorable symptoms, but about the time of puberty they would appear. One case is a woman, where the depression remained and afterward required trephining. It is not good surgery to delay trephining.

DR. PECK—Dr. Jay misunderstood, I did not refer to depression; always trephine where there is depression.

It was moved by Dr Peck and seconded by Dr. Maynard, that the thanks of the Academy be extended to Dr. Perkins for his elaborate and learned paper. Carried.

DR. PERKINS—I wish to thank the Fellows for their very kind reception of the paper, and also to speak of one or two things that have come up. First, in regard to those extradural hemorrhages. I have recently received a report of 160 cases that were done in one hospital by one group of men acting together, and out of those 160 case, 64 were cases of extradural hemorrhages from the meningeal artery in brain injury. As this is nearly 40 per cent. of the cases, one is

justified, perhaps, in cases of an unconscious patient, without any symptoms, in going inside the meningeal artery rather than see the patient die. You will have forty chances in one hundred of relieving him. The basal hemorrhages are more rare and diagnosis is more difficult. The treatment of basal hemorrhage would be more difficult than the diagnosis but it has often been suggested in my mind how easily we could relieve, in a fresh case of basal hemorrhage, if we knew where it was, by a simple insertion of a hollow needle down through the cerebral mass. We often insert a needle into the brain substance in search of an abscess and no harm is done, and I see no reason why we could not put a hollow needle into the basal hemorrhage if we could know where it exists. It would not be necessary to raise the brain from the base of the skull. In regard to the magnitude of certain injuries, it has been stated by one authority that there was no brain injury so great but that it could be recovered from and none so small but what death might result. The most terrible wound I know of was in the case of a man who was struck by a tamping iron, which passed through the malar bone and passed out through the cortex. I have seen the tamping iron; it was a very heavy bar, and went lengthwise through the skull and produced a very terrific injury. The man recovered and has all his faculties, as far as known.

In regard to the position of the speech center, and the loss of certain portions of the cerebral matter we know that the speech center lies in the third left frontal convolution, but it has been found that after the loss of it, its function is taken up by the opposite side of the brain. There is a certain interdependence of the brain from one side to the other, which is used in this case, and so paralysis of speech, permanent paralysis, does not result.

In regard to exploratory operation in simple linear fracture, I do not believe in operating for nothing, and if there are no other symptoms present, I doubt if one would be justified in interfering. One operates for symptoms, not for nothing.

PERSONAL EXPERIENCE IN SPINAL INJURIES.

BY J. F. PRITCHARD, M.D.
DISTRICT SURGEON C. & N. W. RAILWAY.
MANITOWOC, WIS.

The question of spinal injuries has been so much discussed that one feels like apologizing for presenting anything more on the subject, but as it is yet vital in some measure, we must continue our investigation until we have an approximation to the truth.

In going over my records, carefully kept for many years, involving every case of injury on one line of road, I find that an average of injuries to the back was thirteen per thousand. These include all classes of injuries, and are noted on my reports as contusions, sprains, twists, and injuries which are popularly called concussions, also dislocations, fractures and serious injuries of like nature to the spinal column. But what is remarkable is that of these injuries caused by falls, blows, or other like causes incident to railway life there was but one in which recovery was not complete and permanent. My experience would therefore tend to show that so called railway spine is a myth. In reporting cases, I limit myself to those that had marked symptoms.

Case 1.—P. S. Cooney, aged 19; Irish-American, good habits, a freight brakeman, was standing at a switch at a small station to close it as the train passed out of the siding. The gr was slippery and wet, when he, in some way not very '

plained, fell under the caboose. He claimed that the wheels ran diagonally across his hip and the lower lumbar region, which statement was corroborated by his conductor who claimed to have been standing on the ground with his lantern and saw the accident. I think they were mistaken, as the car had switch ropes, chains, links, pins, etc., the usual complement for such cars, which would add about 3,000 pounds to its weight, and would no doubt have killed him instantly. My theory was that he fell in such a position as to go through under the brake-beams and truck-frames, probably doubled up. He no doubt was run over in some such way. When first examined, in an hour or two after receiving the injury, I could find no marks on his body, *i. e.*, no wheel mark or contusion. The spines of the upper lumbar vertebræ were fractured and displaced laterally to a slight extent. He complained of little pain, was totally unable to move his body or legs; had no loss of sensation other than a numbness; no paralysis except as above noted, which seemed to be only an inability to move temporarily. He had full control of bladder and bowels, took his food well and had no rise of temperature at any time. In the course of a few days he complained of a soreness of the muscles with external tenderness over the whole region below the point of injury. This condition improved gradually. He was discharged and resumed labor as flagman on a passenger train, having lost seventy days' time. When discharged his general condition was very good. He had perfect use of all of his muscles and no other difficulty except a slight deviation of the vertebral spines.

Case 2.—Lucian Budyscz, age 18, Polish laborer, was run over by a caboose which he and a number of others were endeavoring to push out of a side-track by hand. The switch was open and a switch engine coming through the yard at the rate of fifteen miles an hour, struck the caboose and injured several men. Budyscz's injuries were multiple and complicated as follows: Right elbow and forearm laid open, requiring resection; comminuted fracture of left femur; injuries to his toes, requiring amputation of two or three; dislocation or fracture of all of the fingers on both hands; injury to the spine similar to Case 1, viz., fracture of spinous processes in lumbar region. He complained from the beginning of severe pain in

his back, and required large doses of morphin to relieve the pain which lasted nearly two weeks. There was no paralysis or loss of function of any organ, and recovery was complete so far as the spinal injury was concerned. The other injuries healed kindly. He was under my charge about six months, until a settlement could be made with him. He never complained of any spinal symptoms afterward.

Case 3.—R. Kroll, age 28; German, foreman of a gang of track layers, who when going and returning from work used two ordinary hand-cars. They frequently raced on returning, and at the time of this accident were racing. A wheel broke while they were running at a high rate of speed, throwing the whole crew forward in front of the car. One man was killed instantly, another received slight injury, while the subject of this sketch fell under the car and was caught at the junction of the last dorsal and first lumbar vertebra in the gear of the car, causing a dislocation. He was immediately paralyzed from this point downward. We operated later and reduced the dislocation by carefully dissecting free the attachments of the spinous processes, then by making lateral traction on the opposite spinous processes with extension from his feet and shoulders, the dislocation was easily reduced. The spinal canal was not opened. He did not require an anesthetic for the operation, and said he had some return of sensation afterward. He died two weeks later. In this case, while we did not have the privilege of a post-mortem examination, it was quite evident that the cord was completely or nearly severed.

Case 4.—John Adamski, Polish, section foreman, age about 40, was attempting to remove his hand-car from the track to clear a special train. The car was struck and he was thrown off, causing contusions of the lumbar and sacral regions which appeared to be muscular only. Later when seen by the writer he complained of nothing but weakness when stooping, no pain or difficulty in walking, no loss of sensation nor any apparent nerve lesions. When the case came into court, however, he had evidently been coached, as he then complained of great pain, loss of use of his right leg, curvature of the spine and in fact everything which would indicate a serious spinal injury. His physicians testified that they found an angular curvature in the lumbar region with contraction of the leg, etc. By

order of the court we examined him carefully. Measurement showed no loss of substance in the leg as compared with the other. We placed him horizontally on his face and in a few minutes his leg became straight. On examining the spine, there was not the slightest deviation from normal. It was an evident case of malingering. The court also took this view and granted a non-suit.

With these exceptions all other cases reported as injuries of the back did not develop symptoms referable to lesions of the spinal cord. In cases 1 and 2, while there were marked symptoms of injury of the cord, recovery was as prompt and complete as could be found in any other region or organ of the body, leading me to the conclusion that while injuries in this region may effect the cord, unless there be some prior disease or tendency thereto, we need not anticipate permanent injury.

All court records with the subsequent history of the patient will bear out the above conclusion, and I am fortified in my belief by discussing this subject with anti-corporation attorneys. It has not fallen under my observation to see a case of railway spine, yet there may possibly be such a condition, or rather an imaginary condition while the claim is being prosecuted, which disappears as soon as the judgment is paid.

I find attorneys out of court agree that so-called railway spine is a humbug, and notably in one case in which a prosecution was brought for an alleged injury of this nature caused by the derailing of a sleeping car. The attorney confessed to me that he did not believe that the woman was hurt at all, but said that she was diseased, of bad character generally, and he could bring his action best for spinal disease.

He said if he had a similar case again he would set up some such state of affairs as this, that she was in such a condition of health that a shock or fright, or similar disturbances would destroy the general equilibrium and cause incurable disease, but under no circumstances would he ever bring suit for railway spine again. I am satisfied that in healthy systems an injury to the spinal cord will cause one of two conditions, either immediate marked symptoms, from which recovery is likely to occur, or when the cord is destroyed, permanent but immediate loss of function of all parts below the point of injury. I do not think in a healthy system the concussion to this region is more likely to produce permanent injury than will a simple uncomplicated fracture cause permanent loss of function of a limb.

MASTOID DISEASES.

BY A. D. BEVAN, M.D.
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I do not know of any other field of surgical work which involves such a thorough knowledge of the parts involved as mastoid diseases and its resulting complications. I would say that I have here a number of specimens selected from a lot of work which I did during last winter; I operated on thirty-five cadavers, made seventy operations on both sides of each cadaver in this line of work, to determine some of the points in regard to the anatomy, especially the position of the facial nerve with relation to the submedial triangle, and to demonstrate the best method of entering the temporal bone and the cerebellum and the sigmoid portion of the sinus.

From experimental work which I did, following very closely in the line of Macewen and Kerner, I determined the points which are practically laid down by Macewen in regard to the opening of the mastoid antrum. The key to the entire situation is the mastoid antrum, and a successful opening of the mastoid antrum can always be made if we adopt and follow these simple rules. If we examine the skull carefully we shall find immediately behind the temporal ridge the posterior border of the zygoma, a ridge running into the temporal ridge. This ridge is the upper line of a triangle known as the submedial triangle. If we

select the upper portion of this triangle as our point for opening the mastoid antrum, immediately below the posterior root of the zygoma, we shall find thus a point about a quarter of an inch behind the external auditory meatus and its roof. Now, if we place a dental bore, which is the best instrument to open the mastoid, or a fine chisel in this direction and open in the direction parallel with the external auditory meatus, we will invariably open into the mastoid antrum. The mastoid antrum is constant. Very often we do not find mastoid cells, but we invariably find a mastoid antrum. The depth varies very much indeed. Sometimes we will find it at the depth of a quarter of an inch, sometimes as deep as five-eighths of an inch from an external surface of the bone, but the landmarks are constant. Now, in order to avoid the important structures in this vicinity, we must understand the exact position of the facial nerve and of the sigmoid sinus. The facial nerve is, as you are all aware, on the posterior wall of the external auditory meatus, running over the facial bone, entering at the internal auditory meatus, it runs first forward and a little upward, until it reaches the stylo-mastoid foramen in the bone; it then makes a right angle turn, then a second right angle turn and comes out. But the simple anatomic fact to remember is this, that the facial nerve is in the plate of bone, between the external auditory meatus and the opening which you have made into the mastoid antrum. Now, that is very important, because you find the statement made by some specialists in ear work (I have seen the statement made several times) that in their mastoid work they first open the mastoid

antrum, then they chisel away the posterior plate of bone. If they do this they will cut the facial nerve every time. It would be the greatest luck in the world if the facial nerve was not cut off, but it can always be avoided if the operation is made in the way I suggest.

Another point: Beside the facial nerve, the position to avoid is the position of the sigmoid sinus. I have drilled here an opening into the sigmoid sinus, a large opening with a trephine at this point, but the sigmoid sinus can practically always be avoided. It is possible that is hardly a fair statement to make, because the best practitioners have opened up the sigmoid sinus in work of this kind, but in work which I have done in the dissecting room there was no difficulty whatever in avoiding the sigmoid sinus. The exact position of the sigmoid sinus you can determine by drawing a line from the articulation of the lower and external angle of the parietal bone to the typical mastoid process. The upper two-thirds of the line will give you very plainly the position of the sigmoid sinus. It is a point which might very often be necessary to determine; in an ordinary mastoid case it would not be necessary to open it. Where we suspect thrombosis, the common thing would be to extend our operation downward and outward, after opening up the mastoid antrum, and expose the condition of the sigmoid sinus. Some of the best work which has been done in this line has been done by Von Bergmann, who makes a very neat suggestion in this work. His routine work is this: First, opening the key of the situation, the mastoid antrum, then if there is intercranial lesion, open up a portion over the

point just about the position of the temporal sphenoid, removing that plate or working it down and exposing the dura mater; then with a spatula elevate the dura mater and from this work backward over the interior surface of the temporal bone. More than a majority of the cases are in the temporal sphenoid alone and a majority are through the dura mater.

Von Bergmann's routine of work is, to open into the mastoid antrum, then to expose the temporal sphenoid alone, if the difficulty is found there, as it is in two-thirds of the cases. If, however, he does not find the difficulty at that point, then he extends the operation from the mastoid down over the sigmoid sinus. If he does not find the difficulty at that point, and there is evidence of intercranial lesion, he extends the operation in the same line. These four operations, mastoid antrum to sigmoid sinus, is an extensive operation and you should go from one point to another until you determined the circle.

One interesting point developed is the fact that following mastoid disease without involvement of the temporal sphenoid lobe or cerebellum, patients have died from sepsis, from a septic thrombus in the bulb of the jugular vein. Just at the point of division there is quite an elevated portion of the vein which extends upward, the bulb of the jugular vein, which has been found in several cases to be the seat of septic thrombus and the effects of general sepsis and death.

Another interesting point in connection with this kind of work is the necessity of ligating sometimes the jugular vein. The work in this direction has as yet been limited and I do not think sufficient in number or exact enough in all of the cases to determine

the exact value of the ligation of the internal jugular. Personally I do not think it is a good method, unless we can actually demonstrate lateral sinus thrombosis and possible involvement of the internal jugular, because you may have, as has been reported, a case in which the internal ear was like this: The patient had sepsis, and it was found that the septic material had blocked up the jugular above the point of the ligature and had been carried in from the other radicles.

My own work in this line has been rather limited. I have to report a number of cases which illustrate the value of this work. I do not believe, however, that I shall take up the time of the Society. There can be no question but that a large majority—that is putting it very safely—a large majority of intracranial lesions can be successfully combatted by early and properly performed operations. Macewen's work, which is the best work that has been done on this subject, shows that out of some twenty cases, he saved over 70 per cent., even after involvement had begun. But the great value that should be recognized by every physician, is the prevention of intracranial lesion. How many times would a simple mastoid operation prevent intracranial lesion? Any one can do a mastoid operation with a knife and gimlet, if he knows the simple anatomic rules which will enable him to open the mastoid antrum itself.

DISCUSSION.

DR. GRISWOLD.—I do not think we ought to let the paper of Dr. Bevan pass without consideration. He mentions the work as comparatively of the same degree with appendicitis. Appendicitis has advanced much farther in its course in the profession in general than the disease of the antrum of the ear.

I recall a case that I think might have been cured if we could have followed Dr. Bevan's advice. Some twenty years ago I was consulted by a young man who had pain in his ear. He had been more or less deaf and had had discharge from his ears since infancy. At this time he was suffering continuous pain and occasional discharge. I turned his case over to an aurist, and in the course of six or eight weeks he died. In the meantime, before he died, the pain got more and more aggravated accompanied by a slight rise of temperature, not considerable, not much increase in pulse and not much mental disturbance and no paralysis; he got a little dull and stupid for the last four or five days of his life; it was pretty difficult to make him understand anything. He did not hear very well with his other ear, but it did not seem as if the disease of which he died caused a great deal of functional disturbance, and I was bound to make a post-mortem examination. I found an abscess, large enough to fill a good-sized teacup with pus. The inflammation seemed to have gone through the roof and affected the dura mater and at last an abscess had formed. The mastoid cells were considerably infiltrated and showed signs of disease, and I have not very much doubt but that the case might have been cured with the advanced surgery that Dr. Bevan teaches now, and that he died for want of good surgery.

CHAPTER VI.—THE TREATMENT OF SEPTIC WOUNDS AND THEIR PREVENTION.

CONTINUOUS SUBMERSION IN THE TREATMENT OF INFECTED WOUNDS OF THE EXTREMITIES.

BY FRED. J. HODGES, B.Sc., M.D.

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Within the sound of my voice to-day are not a few of the men who have been conspicuous in their efforts to place surgery upon a rational basis; to earn for it a place among the true sciences. To such there can be no name so illustrious that its glamour can blind them to the defects of any surgical proposition or procedure, nor can I believe they will fail to consider and weigh the suggestions of even the humblest within the ranks.

Before such a body, not easily influenced by sentiment or selfish considerations, but zealous always for the best interests of our profession, I appear to briefly submit and support the proposition, that in continuous submersion we have the most rapid, thorough and reliable treatment for infected wounds of the extremities yet devised.

We are told that continuous submersion, by which I mean the submersion of a part for any considerable

length of time from twelve or twenty-four hours up to as many days, has for years been very considerably practiced by German hospital surgeons and that it was introduced by them into this country at the St. Francis Hospital, New York, some time prior to 1872.

Such is undoubtedly the case, but the procedure has failed to impress itself upon the surgical literature of either country, the only direct specific references to the practice which I have been able to find being articles by Frank Hamilton in the *Medical Record* for May 15, 1874, and in the January, 1873, number of the old Richmond and Louisville *Medical Journal.*

So far as the writer is concerned the treatment about to be advocated is original.

There came into my service in Cook County Hospital during 1888, a case which had originally been an infected (packing house) wound of the hand that had been poulticed, incised and drained. Later the forearm had been incised and through and through drainage practiced without improvement, so that when it came into my care the hand and forearm were everywhere infiltrated, swollen and sodden. The wrist joint was broken down, passive motion promptly eliciting the crepitus of denuded bone. The patient was by turns delirious from temperature, and maniacal from sepsis. He refused food and was sleepless, and exhausted to such a degree that seemingly death could not be postponed many hours. The nurses of one watch were stimulating him over to the next to escape having to lay him out. What was to be done? Amputation had been considered and dismissed by my predecessors, as necessarily fatal in his weakened condition. Every pocket and recess in the sloughing

tissues had been reached and drained. The dressing had been changed from two to six times each twenty-four hours. Clearly no improvement was to be looked for in that direction. The condition seemed so desperate that I placed the arm in a continuous bath of dilute boric acid solution. In twelve hours the man's temperature had fallen from 104 to 99.5, and in twelve more he was perfectly rational and eating well. His further improvement was rapid and uneventful.

In what is known surgically as "infected wounds," there is usually present a "mixed infection." That is to say, there are present besides the pus organism, the common putrefactive germs which, working in the field prepared for them by the pus organism, add sapremia to the septicemia already existing. In either event the germs themselves are only the starting point, the seeds of the harm which the host suffers. It is only in rare instances that the bacteria in and of themselves directly harm the host, but in their growth, as the result of their life processes—their eating and drinking, we might say—they create and liberate, in the tissues of the host, a number of complex chemic substances, many of them poisonous to their host and all, at least in a degree, poisonous to themselves. Being poisonous to themselves it might be remarked, why interfere, let them stifle in their own excreta. Here the blood stream becomes an important factor. These substances acting under natural laws familiar to you all, pass readily and quickly by osmosis into the blood mass and thus not only influence the adjacent cells but those of remoter tissues, such as the heart muscle, brain, spinal cord and various nerve

centers and ganglia, the integrity of which are absolutely essential to life.

The rational treatment then, of infected wounds must have as its ultimate object, 1, the prevention of bacterial growth; 2, prevention of osmosis of the ptomaines into the blood mass, commonly spoken of as absorption, and 3, such general treatment as shall counteract the pernicious effects of the ptomaines upon the vital tissues. In the past it has been attempted to secure the first results by the use in and about wounds of substances known or imagined to have a destructive or inhibitory action upon the growth of the bacteria. In the very nature of things this course could be but partially successful. Had it accomplished the desired results nothing more would have been necessary, but in point of fact, in the treatment of this class of cases in the past, the greatest dependence has been placed upon drainage and irrigation, which seek to limit or prevent ptomaine absorption. That these measures fail in a good proportion of cases, even when reinforced by stimulants and tonics, is attested by the number of deaths from infected wounds of fingers, hands, arms, feet and legs which occur in the practice of able surgeons; and the number of cases that drag on and on until, should death not occur, the patient is finally dismissed broken down in body and mind. It may seem that no one but an overconfident optimist would dare present a line of treatment with the claim that it would practically always succeed in such a dismal field, but after an experience embracing scores of cases extending over several years of hospital and private practice I come before you today to affirm in the most emphatic manner that con-

tinuous submersion, intelligently carried out, will in the vast majority of cases, save both the life and the limb. That submersion is a prompt and reliable measure in these cases is attested by the experience of every surgeon that has been induced to try it. How the result is produced I will attempt to explain by presenting the line of reasoning which first led to its use.

1. Many forms of bacteria will not develop at the temperature of an ordinary living room. Such as do so, develop less vigorously than at a slightly higher temperature.

2. Many bacteria will not develop in a dilute watery medium, or in ordinary water.

3. Many have not the power of developing in strong healthy tissue but readily do so only after its vitality has been impaired by ptomaines.

4. The group of bacterial products collectively known as ptomaines are mostly crystalloids and all are capable of being influenced by osmosis.

5. Serum and substances dissolved in it, if not already within the blood vessel, will, as the result of a fundamental physical law, seek the "direction of least resistance," which in the case of a part that has been freely incised and submerged in a bland fluid is towards the fluid and away from the blood mass.

To these propositions personal experiment and experience have added the following:

6. Avoiding extremes, the temperature of the bath is immaterial.

7. The utility of the bath depends upon the fundamental physical properties of fluids rather than upon any "drug effects," hence pure water is the best fluid for submersion.

To give even the briefest synopsis of the cases treated by this method would be tedious and uninteresting, but I can not pass without relating the salient points of two histories that well illustrate points I wish particularly to impress upon the Fellows of this Academy.

An employe of our straw-board plant "infected" a slight wound upon the index finger of the left hand. The finger was industriously poulticed for two weeks so that at the end of that time, I found him with hand and forearm immensely swollen, temperature over 104, pulse 120, soft and easily compressible. Much of the time for a week he had been delirious but was at the time of my visit more rational. His physician, his friends and even he himself, considered his case hopeless. I had him conveyed at once to the hospital where, with the assistance of my friend and associate of the Academy, Dr. W. J. Fairfield, the brawny skin and subcutaneous tissues were freely incised and the arm submerged in plain water. Within four hours from the time I first saw him, I left him resting comfortably and painlessly with a temperature under 100. In two weeks he was back at work.

Early in 1891 I was called to take charge of a man that had sustained, nine days previously, a compound fracture (Pott's) and dislocation of the ankle. I found the wound full of maggots and the leg gangrenous to the knee. His temperature was 106 and pulse 130. The gangrene, of an emphysematous type, was extending with great rapidity and wishing to check its advance, improve the patient's general condition and gain time, I freely incised the necrosed tissues and placed the leg in a dilute boric acid bath. In six hours

the patient was free from fever, resting well and able to take all sorts of nourishment. After keeping the leg in the bath for twenty-four hours, I amputated through discolored and emphysematous tissue, to save the knee joint, and got primary union.

In conclusion I beg to again formally submit these propositions.

1. Continuous submersion is harmless.

2. Continuous submersion will almost instantly limit infectious gangrene and control septicemia and sapremia.

3. Continuous submersion will quickly relieve the pain and discomfort of phlegmonous inflammation or cellulitis.

4. Continuous submersion will speedily reduce temperature and pulse and overcome the consequent depression of the patient's vital forces.

DISCUSSION.

DR. H. HATCH—I want to say to the Doctor that submersion is not a new thing. It is thirty years old. When I was a boy I was accustomed, in the neighborhood where I lived, to wait on the sick whenever they would give me an opportunity. At that time there was a doctor, who is now dead, by the name of Moses Wilson, living in the same neighborhood, a graduate of Harvard, who had a boy run over by a stock cutter. This was before the time of asepsis and antisepsis, but I remember distinctly the doctor had me there for three days with a pan with the boy's foot in water all the time. He kept me pouring fresh water in and letting it run out at the other end of the pan. The boy made a good recovery. A physician wanted to amputate the leg, but the boy's father would not allow it, saying that a boy without a leg had better be dead, and the doctor pursued this plan of treatment of submerging the leg in water constantly so as to keep it fresh and clean.

DR. WEBB J. KELLY—I wish to call attention to the fact that Dr. Merz, of Sandusky, Ohio, a fellow of this Academy,

has published an extensive article upon this subject and in which he illustrates his method of submersion.

DR. L. E. LEMEN—These pictures are very familiar to me in one sense of the word. They remind me of the wards of my own hospital. For fifteen years or more I have practiced submersion in all infected wounds of the character mentioned. I have had three or four tin pans made, and have one in each surgical ward in my hospital. They are about twelve to fourteen inches deep and long enough to take a leg up to the knee. In pre-antiseptic days I used to apply bichlorid or some other solution, but for the last four or five years I have used nothing but simple water, and I am satisfied that I have saved many a limb by submersion. I recall to mind a recent case. A man working in one of our smelters wounded his wrist with a piece of slag, which is brittle and sharp. He ran the slag into the wrist through the ligaments and evidently severed the palmar arch. How long he stood letting cold water run on the wrist no one knew. He could not speak English. He finally fainted from loss of blood. Some good Samaritan, a physician visiting the hospital at the time, took a piece of waste material, white cotton, and bound the wrist up with a handkerchief, and when I saw the case the bleeding had ceased. He had packed the wound with some of this waste material. I dressed the wrist. I use considerable cement in my minor surgery, but I do not want to advocate it. A few days afterward I was called to see this man and found his temperature 105.5 F. He was delirious and his arm swollen to the shoulder fully as large as his leg. Realizing that his case was a serious one as he would not go to a hospital, I sent one of my assistants to the hospital to move one of my pans to the man's residence and had his wife change the water freely. The next morning the patient's temperature was normal. We could find no pus, but subsequently two incisions were made which let out a small amount of pus mixed with lymph. If the case had been allowed to go on two or three days longer the man would have had a cellulitis, which would have involved most of the tissue of the arm. Submersion is certainly rational treatment for these wounds.

DR. C. M. DANIELS—I wish to commend the paper. I have had ten years' experience with this method of treatment. In the hospital I have charge of in the city of Buffalo, my method

is identically the one mentioned by Dr. Lemen. The pans are made of tin, and I find I could not get along in a hospital without resorting to this treatment, because there are many cases of infected wounds which come to us, and it is one of the best adjuncts to our armamentarium in the hospital.

Dr. Hodges, closing the discussion—I am in no wise jealous of priority as is shown by the fact that I referred to its ancient use in the German hospitals, but considering that it was so successfully used in St. Francis' Hospital, New York City, by Dr. Frank Hamilton, over twenty-three years ago, it is truly remarkable that so valuable a method of treatment should so long have remained out of general surgical literature. I believe that each year a great many wounded people lose lives that might be saved by this procedure, and it was to bring this phase of the matter to the notice of the Fellows of the Academy that this paper was presented. I have preached submersion and recommended it for several years and have made many converts. I certainly overlooked the reference Dr. Kelly made, but I have repeatedly gone over the *Index Medicus* since its foundation, as well as such other indices at my disposal, without finding other than the references I have given.

If through the presentation or discussion of this paper a single member of this organization who has not previously done so, can be induced to employ submersion, I shall feel that my time has been well spent.

JOHN E. OWENS, M. D.,

CHICAGO, ILL.

Chairman Executive Committee, American Academy of Railway Surgeons; Chief Surgeon C. & N. W. Railway.

METHOD OF OBTAINING THE BEST POSSIBLE ASEPTIC CONDITION DURING OPERATIONS DONE AT PLACES OTHER THAN HOSPITALS.

BY J. F. REGER, M.D.
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Pregnant with glory as are the annals of surgery from its earliest history to the middle of the nineteenth century, illuminated as it has been through the darkness of its endless struggles by the wisdom of such men as Hippocrates, Harvey, Jenner and the two Hunters in the old world, and Physic, Mott, Morton and Gross of the new, it was left to the closing years of this century to furnish such a revolution in surgery as was never dreamed of by its most brilliant and ambitious votaries, as it was thought and taught by the most eminent authorities that ulcerating stumps, sloughing flaps, and discharging sinuses, excessive rises in temperature, gangrene, etc., were due entirely to vicious conditions of the system, humors, imperfect ventilation and poisons that were inhaled; when cleanliness was urged it was as much for cosmetic reasons as any other. When Sir Joseph Lister startled the medical world with the declaration that wounds purified or made aseptic by the use of antiseptics or germicides which destroyed microörganisms or prevented their entrance, or both, and were well drained and covered with dressings containing antiseptics and im-

pervious to the air, would almost always, if not invariably, heal by primary intention with but little rise in temperature and with but little, if any, danger of sepsis or gangrene, he met with a storm of opposition and derision, as did Jenner when he announced that vaccination would stay the progress of smallpox, and as did Morton when he announced that ether would obtund all pain during the progress of a surgical operation. Notwithstanding all opposition the proofs were so indisputable that within a remarkably short period Listerism became an accepted fact, errors and all. The grand results obtained from operations everywhere, after his methods, were ascribed to the beneficent effects of the antiseptics used, more than to the aseptic condition obtained by the use of them. But the road once marked out, it was not long until there were numerous able reviewers each accepting the principle, but each striving to improve the methods. Operations done strictly after Lister's methods were done under a continuous spray of strong carbolic acid solutions and the frequent sponging of the open wound with the same solutions. Reports were soon published of patients who had been dangerously poisoned by the absorption of antiseptic solutions, and methods were sought by which to make instruments, wounds, and the dressings aseptic without the use of antiseptic solutions in the wound where the parts were not already affected. This is the great desideratum we hope for. The hospitals practically have it, but what of the surgeon who does 90 per cent. more operations outside of hospital than in them, who has to deal with floors, ceilings, walls and beds which are decidedly far from clean. I think that this is a wide and useful

field for discussion—a field in which there is yet much to be developed, there being, so far as I have seen, no special lines or rules laid down in regard to such operations. This is why I offer to the Academy for their criticism the method I have used with slight variation for several years. I have three satchels, one large one containing instruments, basins for solutions for sterilizing the hands and a pan for sterilizing instruments by boiling. The other two satchels are of medium size, one containing sterilized dressings, ligatures, sutures, etc., the other operating gown, aprons, towels, table covers and sheets all sterilized with steam. I keep my satchel always packed ready for instant transportation and use. I wrap my dressing gowns, sheets, ligatures, towels and table cover in pieces of canton flannel, securely pinned and keep the packages in a steam sterilizer two hours. They are never opened until the instant they are to be used. Having arrived at the house where the operation is to be done I first have the floor of the operating room well scrubbed with boiling water, some scalded jars filled with boiling water, covered with pieces of canton flannel and set aside to cool; then while some of the bystanders are scrubbing the table to be used as an operating table and a stand or two for holding instruments, I select the instruments to be used including needles and place them in my pan with a weak solution of bi-carbonate or soda and set them to boiling. I then turn my attention to preparing the patient. I have his clothing changed and have him well washed with soap and water; I then have the field of operation thoroughly scrubbed and shaved. After shaving I scrub the parts with soap suds and solution of bi-chlorid

1 to 1,000 and rinse with alcohol; then wrap the parts with a sterilized towel wrung out of a solution of bichlorid 1 to 1,000 until ready to operate. I then select the place in the room having the best light and immediately over the spot where the table is to stand, I have a large sterilized sheet tacked by the four corners to the ceiling; I then place the table on which is a folded quilt freshly washed, if possible to obtain one, and over all spread a sterilized sheet. My assistant after thoroughly sterilizing his hands by first scrubbing them with soap and water, next with a strong solution of permanganate of potash, then with a saturated solution of oxalic acid and rinsing with alcohol, administers the anesthetic, while myself and attendants I have chosen, sterilize our hands and put on our gowns and aprons. The stand is now covered with a sterilized stand-covor upon which is laid the unopened packages of dressings, some sterilized towels and the sterilized instruments still in the boiling solution. The patient now anesthetized is removed to the table and covered with a sterilized sheet. If it be an amputation, the injured or deceased part is wrapped in a sterilized towel wrung out of 1 to 1,000 bi-chlorid solution, the limb is elevated and stroked toward the trunk, and the Esmarch bandage applied. The needles having been threaded and placed in a vessel containing a boiling solution of carbolic acid 10 per cent., the operation is proceeded with in the usual manner, except that I do not use sponges or irrigate or wash the wound inside. I simply sponge clean and dry with pieces of sterilized absorbent gauze. After the vessels are tied and the ligatures cut off close to the knot, I pack the wound with gauze while I place the

stitches; I then withdraw the gauze and bring the edges neatly into apposition and tie. If the flaps are sound I do not use drainage. After dusting with iodoform I cover the approximated edges of the wound with a strip of iodoform gauze, then a few layers of absorbent cotton and a roller bandage firmly applied finishes the dressing. The patient is then placed in a clean bed and the dressing not removed until the eighth or ninth day. The stitches are then removed and the wound dressed as before. I have done a number of operations as described, among them a double synchronous amputation of both legs below the knee. All have healed rapidly and without suppuration, and it is seldom that I apply more than three dressings.

Gentlemen, I thank you for your attention and if my paper evoke discussion which will develop something new and useful in this field it will have served its purpose well.

DISCUSSION.

DR. HENRY W. COE—In reference to the use of permanganate of potash, referred to by Dr. Reger in his paper, I observed during the couple of weeks I spent about the hospitals in Chicago, its use has largely passed away.

DR. WM T. DALBY—The paper read is one of considerable importance, bearing as it does on a topic of this character. As Dr. Coe has just remarked, the permanganate of potash solution has largely died out, and the promiscuous use of the bichlorid solution is not near so frequent as it has been. In cases where we operate outside of hospitals, particularly in emergency cases, it is not only handy but more convenient for the railway surgeon to carry the things mentioned by the Doctor. Boiled water is an aseptic solution without anything being added to it, and I do not know of anything better. I do not know whether it is best or not sometimes to add to our solutions bichlorid of mercury, carbolic acid, or any of the

other agents. The subject of aseptic surgery and aseptic conditions, to be practiced by the railway surgeon in conditions of emergency, is certainly entitled to careful consideration, for we may be called upon at any time to treat accidental injuries where we can not have things as we want them, and we must make the best of the existing conditions and circumstances. The Doctor's paper is a good one, and he has written on a timely subject.

DR. L. E. LEMEN—I was much pleased with the paper, and in regard to antiseptics, I presume it is simply the principle of making assurance doubly sure. Aseptic surgery is what we should practice up to the point when any wound becomes septic. Then, antiseptics come in. I have not for over two years in any of my surgery, abdominal or otherwise, used anything but boiled water and neutral salt solution, and my results have been good. In a case upon which I operated not long ago, an amputation in the upper third of the thigh, I used neither a sponge nor irrigator, simply pouring my salt solution over the stump, and doing it up. On the eleventh day I changed the dressing, and on the thirteenth day the patient was declared well. I did not use an antiseptic during the whole time. I have not for a long time used iodoform, and I will tell you why. A few years ago I used iodoform in my dressings very thickly, and instead of riding home in my carriage I took a street car. Sitting at the opposite end were two well dressed ladies, and one remarked to the other: "He has not taken a bath for a month." Aseptic surgery is what we desire to practice until such time as necessity requires antiseptic surgery.

DR. F. J. HODGES—In the class of cases we have to deal with in railway practice the environment of the patient and the surroundings are of the greatest importance in considering what is absolutely necessary to do in any given case. In an open country, where the railway surgeon is often called upon to practice his vocation, very little attention to these details will secure perfect surgical results, and cases have come to the notice of all of you in which the most important and careful operations have been performed with seemingly no attention having been paid to asepsis, and yet typical results have followed. I do not say this in a way to disparage the practice of aseptic surgery, or that aseptic precautions should not be taken,

but if the loss of time is too great it is better to give the patient the advantage of the operation with such surroundings and means as you can secure, particularly in very closely and thickly populated sections of the country.

DR. C. M. DANIELS—I think the subject is one to which we ought to pay a great deal of attention. It is simply the final closing up of the wound, especially in amputations, and it means more attention than the primary preparation. The Doctor has very well outlined the method of preparing the room, the instruments and the patient, but I think previous to the application of the dressings that the last thing done in the way of thoroughly closing the stump is the most important of all, so far as the avoidance of sepsis is concerned. I quite thoroughly agree with Dr. Lemen in regard to the use of chemicals upon open surfaces, and I have abandoned their use. I do not believe it is necessary to use a chemical, not even bichlorid, iodoform, or anything else when you can secure thoroughly sterilized water, water that has been boiled in a clean receptacle with which the wound may be flushed at the last moment. I have a stream of water pouring into the wound the last thing before applying the dressing, when everything is aseptized. We close up the stump with such means as we always have at hand. Boiled water in a clean receptacle is the most important thing in the whole operation so far as avoiding sepsis is concerned.

DR. L. E. LEMEN—I would like to call attention to the use of the irrigator. I have found since I have abandoned the use of the irrigator that I have union by first intention a great deal oftener—in fact, it is exceptional that I do not have it. At an elevation of four feet, the water coming through the ordinary syringe, striking the cut surfaces of our muscles, the irrigator does far more damage than we have any idea of, and instead of using it I use a large mouthed pitcher, gently pouring from it over all the surface. I do not daub my wound with sponges, lint, or anything else. With proper hemostatic forceps bleeding can be easily controlled. I rarely use them in major operations. I know where the location of my bleeding points is, and I ligate them before I remove my tourniquet. I have had much better results since I have abandoned the old fashioned fountain syringe, as I believe that we do violence to the cut muscular fiber by forcibly ejecting water against it.

DR. C. M. DANIELS—That is my method of irrigating wounds. In amputations of the thigh, I turn the thigh up and merely flush it out, instead of making pressure.

DR. WM. T. DALBY—While we are on the subject of antiseptics I would like to ask whether or not any member has used acetanilid in dressing surgical wounds.

DR. ELISHA GRISWOLD—At the meeting of the AMERICAN MEDICAL ASSOCIATION, held in San Francisco last year, I heard a paper read by an assistant surgeon in the Army, whose name I can not at present recall, on acetanilid as a local application, or as a substitute for iodoform, and which he recommended very highly. Shortly after the meeting I had occasion to dress a contused wound of the hand with it. The patient was a workman in a blast furnace. I washed the wound carefully at first in order to remove all of the septic matter, and I thought I had gotten it all out of the wound. I then sprinkled the acetanilid over it according to the directions given by the gentleman referred to. The result in that case was the development of an erysipelatous inflammation. I converted the wound into an ugly condition, so that it took the patient three or four times as long to get well as it would have done if the wound had been dressed with gauze, iodoform, or subcarbonate of bismuth. The latter has no odor and is as good as iodoform in its results. After adopting the method suggested by this gentleman I was discouraged, and I have not since applied it on a wound. I have tried it on small wounds, and I find that it acts as an irritant.

A MEMBER—Was the wound very much contused?

DR. GRISWOLD—It was not very much contused. It was a lacerated wound on the back of the hand and not a very large one, but an erysipelatous inflammation developed over the back of the hand as a result of the use of the acetanilid. After using it several times subsequently in smaller wounds, I thought the doctor who recommended it had made a mistake.

DR. REGER (closing the discussion)—I believe there is no difference between myself and my critics. I have not for several years applied antiseptics to the inside of a wound, as the paper alleges. A man is brought to you, we will say, with his limbs crushed and covered with cinders, dirt and grease, and the only place where I would use an antiseptic is in preparing the part

for amputation. In crushed wounds you will always find to a greater or less distance from the wound that the tissues are entirely devitalized, and consequently with a few exceptions the surgeon can make his amputation through sound tissue. I do not irrigate. I use sterilized gauze sponges and if there is any oozing of blood after the surface is closed it must be aseptic and must absorb harmlessly. I use all my antiseptics prior to the operation. I take everything along with me to make my operation as nearly aseptic as I can. The sheet is for the purpose of preventing any particle from falling into the wound.

Chapter VII.—Sanitation.

SANITARY REGULATIONS GOVERNING RAILWAYS.

BY L. E. LEMEN, M.D.
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It is not often that a railroad surgeon is called upon to speak before you upon matters pertaining to public health. Yet, in this particular, we are not to judge the future by the past. This is truly the era of preventive medicine, because we find not only all branches of medicine battling against every scourge, but the public in general has its thoughts set on the laws which are apt to conduce to good health. It would seem that, at last, the laity has commenced to appreciate the meaning of the old adage: "Public Health is Public Wealth."

In the revolution that is now taking place in scientific and social circles to promote the health of the people it behooves the railway surgeons, and railway officials to pause for a moment as to their duties and capabilities. To remain inactive in matters of this kind will be considered criminal and costly, and instead of deferring the necessary preventive measures in certain diseases until the railroads are compelled by State and National statutes to observe laws more or less stringent and often impracticable, it would appear to be the part of wisdom, first in the railway

surgeon to pay special attention to State and municipal hygiene and the laws of the different localities governing the same, and second for the railway managers themselves to instruct their agents to supervise and direct as much as possible the sanitary legislation referring to public carriers.

In all the concerted effort for the public welfare now taking place we find State medicine especially concerned in restricting the spread of tuberculosis in general, and tuberculosis of the lungs or pulmonary consumption, in particular. It is on the subject of the latter that I propose to speak more especially as a railroad surgeon.

The value of Koch's discovery in fixing the specific cause of phthisis to the invasion of the tubercle bacillus is magnified day by day as we contemplate the possibilities of State medicine toward stamping out disease.

That pulmonary phthisis is a communicable disease no one will to-day question. The mode of spread is various, such for instance as: 1, taking the germ of the disease into the system by drinking infected milk; 2, the ingestion of diseased meat; 3, from the expired breath; 4, accidental contact with the expectoration and the discharge from tuberculous sores; 5, inhalation of air laden with bacilli from dried tubercular sputa.

Of the methods by which the disease is communicated, the latter, namely, the inhalation of air laden with bacilli from dried tubercular sputa, is recognized to be the most common. It is in this mode of infection that the railroad surgeon is principally interested since overcrowding in cars, poor ventilation and faulty

construction specially favor the spread of the disease.

We have every reason to believe in the potency of isolation for the restriction of the spread of tubercular disease, and we read the signs of the times from those boarding houses and hotels who now advertise for non-tubercular patronage at the same time that sanitarians are advocating the value of segregation of consumptives into properly built cottages away from populous centers.

Facts such as these offer suggestions of value to railroad officials. If it is manifestly dangerous to receive the tubercular subjects in hotels and boarding houses occupied by people generally what should be the rule to be observed in railroad travel in a country like ours where people have such a tendency to move about? Take for instance railroads leading to resorts for consumptives where a great percentage of the travel is done, especially at certain seasons of the year, by the infected class, and then figure on the ill effects of permitting the sick and the well to travel together.

The time has arrived when the railroad sanitarian must point out these dangers. As scientific men we do a great deal for the cause of preventive medicine. I believe it is important that we should recommend the following.

1. Segregation of the consumptives in railroad travel.
2. The compartments of the infected individuals should be constructed in such a way that disinfection and cleansing may be easily accomplished.
3. The sleeping cars should be provided with drapery easily laundered, and all drapery should be washed as often as once a month.

4. The bedding of the isolated compartments should not be interchangeable with that of the other part of the car, and articles like blankets and mattresses should be steamed at least once per month.

5. The dangers of spreading the disease through the medium of dried sputa should be stated in circulars conveniently posted in the isolated compartment, and the necessity of expectorating into spittoons and not on the floor or in handkerchiefs should be specially dwelt upon.

DISCUSSION.

DR. C. M. DANIELS—In the new instruction book I am issuing to the physicians and employes of the road I represent, I have added a clause directing surgeons, when traveling over the line, to make an inspection of the train and in case any unsanitary conditions are found, that attention be immediately called to the same and reported promptly to the chief surgeon.

CAN WE IMPROVE UPON THE SANITARY CONDITION OF OUR CARS?

BY WM. T. DALBY, M.D.
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I take it that every physician is a sanitarian; if not, he should be. The doctor's true sphere of action is not confined to disease alone, but embraces man's whole life when in a state of health as well as when in a state of disease.

A knowledge of the laws of hygiene is essentially necessary to the education of every physician, and its worth as a true science is of no less importance to the general public. We find in searching the archives of the past that those who preceded us in our noble calling recognized the science of sanitation as a true sister to the art of medicine as well as her greatest, brightest ally. Every civilized government has assumed the inherent right to protect the health and provide for the safety and welfare of its people; and this is not merely a presumed right, but it is a duty and obligation which the soverign power owes to the public. That this is true and that sanitation has been from the remotest period of history an integral part of medicine and accorded a place of distinction in the councils of ancient governments can not be denied. Let us for a moment, as a prelude to this paper, look into the realms of now almost forgotten

history with reference to the laws governing public health.

This department of science (sanitation) has received so strong an impulse during the past few decades that many persons regard it as of modern origin; but on turning back to the records of early history we almost invariably find evidence that the health of the general population was a subject of legislation.

The Mosaic code of laws, the most ancient on record, contained minute directions for cleanliness of the person, the purification of the dwellings and the camp, the selection of healthy and the avoidance of unhealthy food, the seclusion of persons with contagious disorders and various other points bearing on the physical well-being of the Jewish nation.

The Greeks and Romans—although not like the Jews, making hygiene a part of their religion—were far from neglecting it. The laws of Lycurgus, says Dr. Gairdner, "are not wanting in very pointed enactments on sanitary matters; and the importance attached by the Greek Republic, and in the Platonic polity, to physical culture is too well known to require remark."

"The Roman people, poor and apparently rude as it was in its origin, yet found time, amidst its military operations, to construct the *cloaca maxima*, an indestructible and stupendous memorial of its attention to the drainage and sewerage of the city at a very early period of its history. At a later period aqueducts were made to cover miles upon miles of the surrounding plain; and their splendid ruins, still partly used for their original purpose, attest the

munificence and the abundance with which the first of sanitary requisites was supplied to the imperial city." When state physicians were first appointed in the Roman Empire is not certainly known. Their mode of election is described in the Theodosian and Justinian codes. There were ten of them in the largest towns and to each district or subdivision, seven in towns of the second order and five in smaller ones. They collectively formed a college whose duty it was to attend to public health, and they may be regarded as the earliest type of our general medical council.

We find on our own continent that the ancient and energetic Aztecs were not ignorant of the laws of sanitation; and long before the sailing of Columbus from Palos, we find that their water supply and efforts at drainage evidence their knowledge and appreciation of hygiene equal to if not superior to that in vogue in some of our municipal governments of to-day.

Gradually, however, as Christianity spread, an utter misconception of doctrine led to the neglect of all care of the human body, and the question of public health, the foundation of a nation's wealth, growth and happiness, was ignobly buried in the darkness of the middle ages. It has now been unearthed by the inexorable demands of modern enlightenment, and gaining ascendency, has greatened and glorified medicine without marring the luster of her scientific consort, and to-day she turns to the people and their rulers, outside the medical fold, and demands as her right a place of honor in their councils. Thus we see that from time immemorial it has been as much the physician's duty to regard the laws of sanitation as to

treat the ills arising and sure to follow a violation of her mandates.

When we find that the air of passenger cars is shown upon careful examination to be equal in impurities, greater in amount of carbonic acid than some of the sewers of our cities, and the sleeping car to be pronounced a "hot bed of infection," it is time for us as railway surgeons on behalf of our respective railway companies and our duty to the traveling multitudes to investigate and see whether or not we "can improve the sanitary condition of our cars."

Permit to quote from a recent edition of the "National Board of Health Magazine."

"Everybody knows that the aim of the car-builder of the present day is to make the sleeper a palace on wheels. The seats are upholstered with the softest material, combined with reasonable durability; the carpets are most velvety; the curtains soft and rich; the mattresses, pillows, blankets and coverlets of the best. The whole furnishing of the car is similar to a private drawing-room."

Who could ask for more in the sense of comfort? And what is here said of the sleeping car, can be with equal propriety and justice claimed for the passenger car. We know that the passenger car of to-day is the evolution and product of many years of careful study, and it would appear that in meeting the demands of the traveling public it has nearly reached the limit of perfection in dimension and compactness as a component part of the train. In many instances from the artisan's point of view it is constructed both as elaborately and comfortably as the handiwork of the mechanic can devise. In the life and competition for

trade, the rapidity and comfort in transit has stimulated our various railway companies to build and improve the passenger car so rapidly that we look with admiration at the results achieved in all that is artistic and beautiful in veritable palaces on wheels, speeding over mighty domain as true evidences of the skill and enterprise of our progressive people. With all this, however, we must admit that the sanitary condition and arrangement of the passenger car is bad, and this condition is often made worse through neglect or ignorance in the use of those means at hand provided for its ventilation and cleanliness. There is no doubt that had the mechanic gone hand in hand with the sanitarian in the construction of the passenger car, greater results would have been achieved. Certainly, so far as lighting, heating and ventilation is concerned, measures have been so far neglected as to call for legislative enactments in many instances, and a world of literature looking to the correction and improvement of the existing evil.

We quote further from this article by Dr. Pattison, on "Car Sanitation." After describing the various physical conditions of those who travel in the sleeper, and noting the infectious nature of tuberculosis he says: "And the tuberculous patients travel more than any other classes in search of suitable climate. Persons suffering from phthisis pulmonalis are to be met with in the sleepers upon nearly every transcontinental train. They cough and expectorate as all such do sometimes in the cuspidor, sometimes in the handkerchief, but very frequently on the carpet as this is not their own. When on the last, the germ-laden expectoration becomes rapidly dried and ground with dust,

rises in the air of the car and is inhaled by the susceptible fellow passenger, often an innocent stranger. It is quite rational to presume that in this way the fatal disease is often spread."

The doctor then goes on to say: "What, after a time is the sanitary condition of the sleeper? It becomes simply a hot bed of infection. It can not be otherwise, for no efficient measures are taken to prevent it. The sheets and pillow cases are changed daily, sent to the laundry. Allow that they are thus purified; what is done with the mattresses, pillows, blankets, coverlets, and curtains? They are closed up from sunlight and air in the upper berth, and for months at a time they are never exposed to nature's purifiers."

"So far as the car itself is concerned, at the end of the trip, the carpet is swept, the cushions brushed in a dry condition; a profusion of germ-laden dust rises to settle again; what falls upon the wood work, and is visible, is brushed off with a duster to settle again on the carpets and cushions, where all remains in the most favorable condition to be raised into the air by the next set of passengers and the motion of the car upon the return trip. To my mind, the sleeper of to-day is an extremely active factor in the propagation of infectious diseases, more so on account of its luxurious furnishings than other cars."

It can not be said that these remarks are overdrawn or exaggerated, neither will anyone doubt the infectiousness and contagiousness of tuberculosis nor the vast numbers who are constantly traveling afflicted with this disease in search of genial climes to invigorate their exhausted frames. What an infectious

field the car from such contamination becomes in spreading disease among the innocent and unprotected public. And tuberculosis is not alone in the consideration of this unwholesome state of affairs, for the germs of many other infectious diseases are lodged and housed up through this want of better hygienic measures to wreak vengeance upon the unsuspecting.

Many suggestions have been made with reference to abating this evil, including many alterations in the construction of the car, the abolishing of the draperies and tacked-down carpets and other furnishings that will not withstand the proper methods that should be used in a thorough fumigation and disinfection.

Restrictions are likewise suggested to be imposed upon invalids requiring them to have certificates from the proper authorities showing freedom from infection as is necessary in the transportation of the dead. Many of the suggestions are practicable and could be easily put into operation, and carried out with little expense.

It is questionable, however, if under our form of government, State or federal, invalids could be obliged to present a certificate showing freedom from infection before being permitted to obtain transportation as it is required in transporting the dead.

It is certainly true, that it is as dangerous and hazardous to the public to carry by rail the infectious living as it is to carry the infectious dead, and probably more so, since the carrying of the dead will never equal in number the invalid class nor are the conditions of possible contact the same; to have in the same car persons afflicted with infectious diseases disseminating and spreading germs under the most

favorable conditions is much more dangerous to the public than are the infected dead in the baggage car.

Still, the law of equity would grant privileges to the one that the relatives of the other could scarcely exact as an inherent right. We can not prevent the infected from traveling no matter how plainly we may demonstrate the death dealing germs left in their wake. We must exert sanitary measures and precautions and depend on these to protect the public from disease.

If we wish to improve the sanitary condition of our cars we must not only look into the questions of ventilation, heating and lighting, but we must go beyond this and show to the car builder the wisdom of consulting and associating with the mechanic the ideas of the sanitarian. It is difficult and, in many instances, quite expensive to improve upon a poorly constructed car from a sanitary standpoint, and to attempt such improvement would necessitate an outlay greater than many of the companies would be able to bear. To accomplish the most good by having a properly ventilated car, and one that is susceptible of the greatest cleanlines, we must direct our attention to the building of the same. It is said that the most intelligent men of our country are engaged in the management of railways, and the fact that so little has been done in the way of railway sanitation is simply because these gentlemen are unaware of the value of such a departure, and have not been made to see the monetary gain that would accrue to their several companies by the proper enforcement of sanitary laws. This is undoubtedly true; so, also, is it true, that in a great organization of railway surgeons as we have here, the importance of sanitary measures

with reference to the hygienic condition of the coaches should be studied, and the knowledge thus derived should be given to our respective railway companies for their information and guidance. I do not think that we should so long ignore these matters of vital importance as to let the legislative branches of our government step in by their enactments and describe, for instance, the manner in which heat should be applied to the train, any more than we should wait and expect from this same source information and instruction regarding the treatment of fractures and other injuries resulting from wrecks. I trust that it will be the sense of this association to deem it a duty incumbent upon it and always to look into the sanitary condition of our cars with a hope of improving it.

I do not intend to attempt in this paper to suggest to you what would be the most improved ideas of car sanitation. This must be reserved for the more efficient sanitary engineer, whose scope and field of observation is far greater than mine.

To this same expert must be left the plan of ventilation, complex and difficult of solution as it is, the maintenance of proper temperature and the best system of water-closets. All of these are susceptible of vast improvement.

The question of cleanliness, however, in the car proper, the water coolers, the purity of the ice and water supplies are matters that we are capable of coping with. If it is carried out by some regulated system of rules enforced by all the railway companies alike, a more wholesome and healthful condition will result to the public and we will be credited with the

honor of having improved the sanitary condition of our cars.

All coaches, day or sleeping, especially after long trips, should be subjected to a cleansing and disinfection. This can be done in several ways and should be provided for in the necessary instructions given the employés having this matter in charge. The same rigid rule should apply also the bed, bedding, carpets and draperies of the sleeping car. Not only should the car be cleaned at the end of each trip, but as far as possible it should be kept so while in transit. Since many people of filthy habit travel, the necessity of this will become obvious. The water coolers, which are scarcely if ever washed, should receive closer attention; likewise the ice and water with which they are filled, and the often disgusting manner in which this is done. The cuspidors should be cleaned as often as necessary, and when used by the tuberculous, should be disinfected; and until a better system of closets are devised, dry earth or a freer and more elaborate system of flushing should be provided.

Whatever system is adopted looking to a better sanitary condition of the cars should be one that is enforced by all the roads alike.

In concluding this paper, I thank you for your kind consideration and hope that I have been successful in showing why we as railway surgeons should be sanitarians, and why some of our deliberations should be in the direction of the improvement of the sanitary condition of our cars.

DISCUSSION.

DR. REED, of Columbus, Ohio—I believe I have been generally known as a sanitary crank, and I presume that for an indi-

vidual who has as little money as I have to spend in this matter, I have spent perhaps as much as any man in the country in investigating the matters about which the author of the paper has written. I made a sanitary inspection of the Big Four, the Panhandle, Pittsburg, Fort Wayne and Chicago and the Baltimore and Ohio Railroads some years ago. This inspection consisted in the investigation of the air by chemic analysis, the investigation of the cars, the plan of heating, the water-closets and the ventilation; the temperature of the car at the floor, at the level of the mouth and at the ceiling, and it required no small amount of time, work and expense. After examining this matter carefully I found a great many things to recommend in my report. I had the pleasure of sending a copy of this report to President Pullman, and received a reply from him stating that he believed my suggestions were good. The trouble usually arises with the superintendents and the managers, who are, so to speak, between the devil and the deep sea. They are anxious to make the cars as comfortable and as handsome as possible to accommodate the traveling public, and on the other hand they must curtail expenses in order to maintain their positions as servants of the stockholders. To add these improvements means expense, and so long as the traveling public does not make any special claim for improvements on the cars, they do not feel inclined to make them. I do not think there is a general manager who would not admit that the paper read by our friend here was right and every word perhaps in it true, but they look at it from a business standpoint only. Quite a number of general managers have expressed their opinion to me on the subject and have said there was no question about its importance, but that so long as they were not required to make these improvements in order to get passenger traffic over their roads they did not deem it necessary to take the lead in the matter. I have no doubt Mr. Pullman looks at it in the same light. He sees very plainly that an elegantly fitted car, when placed beside another on the track that is not so elegantly fitted up, at the same price and going to the same place and making the same time, will be preferred by the public. I believe that until the public is educated in the matter you can not get the railway companies to adopt a new plan until the riding

public demand it, and say to the railroad managers, "We won't ride on your road unless you give us a sanitary car to ride in." I think the time will come when we will have these improvements, because I am sure the companies will be ready to make the expenditures if they see a return for this extra expense, but they do not feel like making the expenditures otherwise. Railroad companies are not organized for philanthropic purposes; they are organized strictly on business principles, and unless this can be demonstrated as a business enterprise, I do not believe it is possible for us to reach improvements.

DR. BEVAN—I believe that the paper of Dr. Dalby touches a very important kind of work, and the question has occurred to my mind whether or not it would not be possible for this Academy to bring out results of some practical value in this line. Whether it would not be possible for us to very thoroughly, as an Academy, investigate this whole subject and formulate some practical rules which we, as the Academy of Railway Surgeons, could recommend to railway companies, even to State legislatures, or the Interstate Commerce Commission. It certainly is a very valuable line of work, and it must be carefully worked out by just such men as the members of this association. With this in view—this is merely a suggestion—I should think at our next annual meeting it would be well to have several papers covering this entire ground, not only in a general way, as Dr. Dalby has done, but in a specific way, with specific and practical recommendations to the Academy.

DR. JOHN E. OWENS, of Chicago—I have for a long time felt that something in the direction of this paper should be done. In taking a long ride of 800 or 1,000 miles I have now and then watched the different varieties of the genus homo that refreshed himself or herself at the drinking fountain or water cooler, some evidently with pulmonary disease, tuberculosis, etc., and in a sleeping car, unless I am sleeping. I believe as the matter of tuberculosis is getting so well understood, slowly, it is true, by the public, and also in consequence of the existence of such papers as has been given us by Dr. Dalby, that the public, and consequently the railroad companies, will feel the evolution in the right direction and eventually we will have some attempt in the way of the construction of a car which

will meet the objections presented by some of the luxurious cars in which we now ride. It will be a matter of very slow progress. I take it that some enterprising company will build one sanitary car and run that for a time; perhaps some other company as an advertisement will set forth to the public that the Sanitary Car will leave Chicago for Denver at 8:40, with no possible danger of any contagion or infection. It will come about in some such way, but the doctor can not do it unless he has the coöperation of the railroad authorities, as has been suggested, and with them the sanitarians of the country. The public health associations and all the represenative bodies of this character in the country will in time, I presume, coöperate and their united effort will bring about the desired results. Certainly all the conditions for the spread of such contagion must be present in both the day coach and the sleeping car, as has been set forth by Dr. Dalby in his paper. The public, as has already been stated, comes very slowly to a realizing sense of what they should do to protect themselves, They don't appreciate what is done by others; we see that in the hospitals. It is useless to give a consumptive in a car a spit-cup to use and to throw out of the window. The carpet that he does not own, and the floor will be used in preference to these, however accessible they may be. I have not anything to recommend.

Dr. Maynard—Following the paper of Dr. Dalby and following the line of Dr. Owens, I have noted for a great many years the unsanitary condition of cars, as a rule. All well-to-do consumptives travel by sleeping cars. It is through the agency of such an organization as this that we can do some good in a sanitary way. I happen to have a very close personal acquaintance, extending over a great many years, with the Pullman Company, the leading sleeping car company in the United States, and I know that Mr. T. H. Wickes, the vice-president and general manager, and Mr. Gusten, the general superintendent, are anxious to do all they can, not only to make the traveling public comfortable, but to make their cars sanitary. I know this fact from conversation with Mr. Gusten to-day that they will be very glad to do anything they possibly can in order to make their cars sanitary, and would, I believe, take the lead in any movement that might have the endorsement of such an organization as we are, and consider any well-formulated and

well-digested plan that might be presented to them. As to railways generally, they are like the rest of us, after the dollar, and as long as the suffering public are not educated and will put up with it, they will give just such accommodations as will keep up their passenger receipts. But any well-defined and well-formulated suggestions from an association of this kind would receive, from the Pullman Company at least, not only a courteous reception, but would be met more than half way. I know the danger. I see the consumptives on the road, hear the cough, see the spit, and as a rule I ride on the baggage car to save myself. But I believe it would be well for us to formulate, in the line of Dr. Dalby's paper, a set plan and submit the same, not only to the sleeping car companies, but to all passenger carrying roads.

DR. W. J. GALBRAITH, of Omaha, Neb.--I fully appreciate Dr. Dalby's ability to write upon sanitation as well as his ability in the profession in general. While it may be humane and it may be sympathetic for us to look upon this matter in the way we have, I do not deem it in the province of this association to make recommendations that we are not called upon to make by our general managers. It would be just as absurd for us to make recommendations how a locomotive should be made, how a road-bed should be graded, etc., as to enter into something that has no connection whatever with our positions. We are employed as surgeons and physicians to railroads to care for the sick and injured employes and those for whom the railroads are responsible. It is the duty of the master car builder and his associates and the chief engineer to put into practical execution all these measures that we are discussing, and they are constantly working upon sanitation, as well as the general improvement of their rolling stock. They are men who are educated and and men whom our general managers depend upon to make such sanitary conditions, as well as safety conditions to transport their passengers. We have had in associations heretofore papers that have done railroad surgeons' associations a great deal of harm. I believe that the recommendations of Dr. Conn as contained in his paper have done more injury to the railroad surgeons and their societies than all other actions that have taken place during our short existence. We speak from a sympathetic and humane standpoint, which is

all right. I appreciate that. I think it is all right for those things to be considered. At every discussion pertaining to the sanitation of cars, the first object has been tuberculosis. It is not directed to the public in general where the families intermingle and sleep together, in hospitals, where you have a tuberculous patient and one suffering from a different disease right next to him. Those things are not taken into consideration. We are not making recommendations in the proper channel. I believe that the paper by Dr. Dalby is a very valuable one; it shows good judgment and good sense, but if it is printed and the transactions sent to our general managers for review, we will be doing a great deal more harm than we will be doing good. It is something that we are not called upon to perform and it is not our duty to make those recommendations. Now the hospital care for the transportation of patients. This is a matter we have discussed in associations heretofore, and I have had it repeatedly from two or three different sources and from general managers, how absurd it would be for every trunk line to furnish cars for the transportation of tubercular patients. It is entirely out of the question that a trunk line can afford to equip cars to start from Chicago to the Coast, to have a special car arranged for the transportations of tubercular cases. It is just as absurd as it is for the accident cars we have made recommendations for in associations I have been connected with. We have recommended that automatic couplers be immediately placed on all roads. What business have we to make such recommendations? None whatever. That is not our province whatever. I have fought the automatic coupler, I have fought the tubercular cars and the accident cars from the time our organizations of railroad societies started, and I hope this will be the last fight I shall have to make.

W. J. GALBRAITH, M. D.,

OMAHA, NEB.

Chairman Committee on Transportation, American Academy of Railway Surgeons; Chief Surgeon Union Pacific Railway.

Chapter VIII.—Medico-Legal.

OBSERVATIONS CONCERNING THE LAW OF PRIVILEGED COMMUNICATIONS BETWEEN PHYSICIAN AND PATIENT, AS APPLICABLE TO THE DUTIES OF RAILWAY SURGEONS.

BY HON. TRACY C. BECKER.
BUFFALO, N. Y.

Gentlemen of the Association.—I highly appreciate the honor conferred upon me by being invited to deliver an address at the meeting of the American Academy of Railway Surgeons on some topic connected with the medico-legal aspects of railway surgery; and upon reflection, have deemed it advisable to devote the time alloted to a consideration of the laws concerning "Privileged Communications between Physician and Patient," particularly as regards the application of these laws to the duties of railway surgeons.

As I understand the status of the members of your body, nearly every one of you is under contract of regular employment by some railway company, by which, in cases of accidental injury to its employes or its passengers, it becomes your duty to visit such cases and to give them the benefit of your professional knowledge and skill. If so, you are not, in the strict sense of the term, employed in your professional

capacity by the party interested. It, therefore, becomes important for you to be informed as to how far any knowledge or information you may obtain while treating such patients can be disclosed without violation of your legal duties as prescribed by the statutes of the various States in which you perform those duties.

It is a singular and not commonly known fact, that under the English common law, while inviolable secrecy was required to be observed by attorneys with reference to communications which they received from their clients, no protection from disclosure in evidence in a court of justice was extended to communications between a medical man and his patient. The reason for this distinction has been said to be, that the privilege was founded upon considerations of public policy in the administration of justice in the courts. Attorneys were a part of their system, while physicians were no part of that system, and while the compulsory examination of lawyers as to communications received by them from their clients would tend to discourage confidence between client and attorney and to the suppression of truth in litigation, the disclosing of confidences given to physicians could in no way tend to weaken the administration of justice or to render it ineffectual.

The hardness and inequality of this rule, and the danger which was liable to follow from a disclosure by medical men of what they learned from patients as to their past life and family history, and the cause and character of their injuries, diseases and the like, have led to what was believed to be legislative reform in this country, and statutes have been passed in many of the States and Territories restricting dis-

closures by physicians of information received by them while acting in their professional capacity. Up to September 1895, the following twenty-five States and Territories had statutes of this character, viz., Arkansas, California, Colorado, Idaho, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Utah, Washington, Wisconsin and Wyoming; while in the other States the rule of the English common law is still followed and there are no restrictions upon such disclosures.

In many of the States there is a declaration of the policy of the statute prefixed to it, and this declaration is to the effect that there are particular relations in which it is the policy of the law to encourage confidence and to preserve it inviolable, and that, therefore, the prohibition of the statute is laid.

In California, Idaho, Minnesota, Montana, North Dakota, Oregon, South Dakota, Utah and Washington, the statutes are made to apply solely to civil actions. The statutes in other States make no distinction between civil actions and criminal actions. In some States, for example in New York, the statutes permit of a waiver of the privilege after death of the patient by his heirs or next of kin. In other States the power of waiver dies with him, and no one has the power of waiver after his death.

In Arkansas the information must be a *confidential* communication. (Collins v. Mack, 31 Ark. 684.) But in other States the rule has received a broader interpretation, and the general tendency of the courts in those States is to give the statute broad scope and

effect, and to bring within its restrictions every kind of information which the medical man gains while in attendance upon his patient about his case; and the proper test may be said to be whether such information would have been given him had he not been in attendance in a professional capacity. It, therefore, includes not only what the patient tells the physician as to the disease or injury, and as to the cause of the injury, but the physician can not disclose what he learns by his own examination and investigation, or from statements made by patient even in the presence of a third party.

Hence it has been held that admission made by a patient to his physician tending to show contributory negligence on the part of the patient at the time he received the injury, are not admissible; and a physician has been prevented from disclosing whether his patient said that the car on which he was injured was in motion when he received his injury, because the injury would be likely to be more severe if the car was in motion. (Reynolds v. Burlington C. R. & N. R. R. Co., 65 Iowa 152.)

The fact that the physician does not prescribe for the patient, or actually treat him, is immaterial, for the status operates upon the communication itself and the professional capacity and presence of the physician. "If the act is a professional act, it is within the scope of the law. *Medicus optimus medicamentum minimum* is the maxim used in one case to illustrate this point." (In the Matter of Freeman, 46 Hun. 458.) Chas. A. Boston; Article on "Privileged Communications," in Witthaus and Becker Medical Jurisprudence, New York, 1894.

It has also been held by the United States supreme court, that in cases triable in the United States courts in States where, by law, such communications are privileged, the U. S. courts will enforce, as a rule of evidence, the rule laid down by the statute in such State. (Logan v. U. S., 144 U. S. 263. Conn. Mut. L. Ins. Co. v. Union Trust Co. 112 U. S. 250.)

Having thus briefly explained the statutory regulations concerning such communications and their scope and effect, the question suggests itself for discussion how far such rules apply to railway surgeons who, in the employ of their company, visit patients and gain information after an accident or injury, examining their cases and treating them in a professional capacity.

I have no hesitation whatever in expressing the opinion that a physician acting in that capacity and under such circumstances, although not strictly in the employ of the patient, necessarily gains his knowledge from the fact that his services are rendered in a professional capacity, and that, therefore, any knowledge or information which he obtains under such conditions can not be disclosed, except upon the express waiver of the patient during his life time, or, in States where that is permitted, by his legal representatives after his death; the single exception probably being that in an action against the physician for malpractice, if the patient testifies as to the manner of treatment, the physician is then at liberty to introduce his own testimony, or that of another physician, as to the facts thus put in issue by the patient. (Lane v. Boicourt, 27 N. E. Rep. 1111. See also, Winner v. Lathrop, 67 Hun. 511.) And the rule in California is

that where a physician is cross examined by his patient, calling for privileged matter, the privilege is waived. (Valensin v. Valensin, 14 Pac. Rep., 87.) But in a recent case in New York it has been held that although a physician is compelled to sue his patient for the amount of his bill and the patient denies the employment, the physician can not testify to what he did or prescribed for the patient. In New York a very analogous case to the relations of railroad surgeon and patient occurred in the case of Grattan v. Met. Ins. Co., 24 Hun. 43; same case on appeal to the court of appeals, 92 N. Y. 274, where another person employed a physician to examine the patient and report, and it appeared that the person examined did not desire any knowledge as to his condition; yet the court held, that, as the examination was made as a professional act, the relation of physician and patient was established between the physician and the person examined even though there was only an interview. In another case in New York the public prosecutor sent a physician to a person for the purpose of making an examination, so as to obtain evidence against another person charged with crime, and the person examined accepted the services of the physician in his professional character, and it was held that the physician could not testify as to the results of the examination. (People v. Murphy, 101 N. Y. 126.)

It is true that there have been other cases in New York, and perhaps in other States, which seem to vary this rule somewhat. In one case, for instance, where the physician stated that he was simply there at the instigation of another party to examine him, and not for the purpose of prescribing, and the exam-

ination was held in the presence of the patient's attending physician, it was held that the relation of physician and patient was not established. (Heath v. Broadway & S. A. Ry. Co. 8 N. Y. Supp. 863. See also Henry v. N. Y., L. E. & W. R. R. Co., 57 Hun. 76. People v. Kemmler, 119 N. Y. 580. People v. Sliney, 137 N. Y. 570.)

In Missouri it was held that information as to the way in which an injury was inflicted is of the greatest necessity for successful treatment, and that it is information which physicians invariably demand and receive, and should be excluded. (Norton v. City of Moberly, 18 Mo. Ap. 457. Streeter v. City of Breckenridge, 23 Mo. Ap. 244.)

If the rule be as strict as I believe and have stated it to be it becomes a serious question for your consideration whether or not an effort should be made in the different States to have amendments adopted which shall modify the statutes somewhat in that particular.

Speaking as a lawyer, I am inclined to think that the rule as it now stands is a salutary one, so far as relates to ordinary diseases and mental and physical conditions; but that where a railway surgeon is furnished by the railway company and sent from place to place to treat patients without charge to themselves, if they knowingly accept his services and proceed to give him an account of the accident, and to disclose circumstances which would benefit the company by showing, in case of suit brought by him during his life time, or his representatives after his death, that he had brought the injury upon himself by his own fault, the rule ought not to be so limited and restricted

as to prevent the disclosure of what is thus learned.

While it is in a general way, as has been said above, important and essential to know the nature and cause of the injury to enable the physician to treat the injury properly, nevertheless it is not so absolutely necessary and essential that perhaps the only intelligent and truthful witness whom the railroad company could call to show by the admissions of the patient how his negligence brought about his injuries, should be excluded from testifying. This is a question which is peculiarly one for your own good sense and good judgment to determine.

The theory on which admissions of a party to an action are admitted on behalf of his opponent, is that he would not tell what was against his own interests. For this reason Mr. Best, in his admirable work on Evidence, divides admission evidence into two classes, one of which he denominates "Self-serving evidence," that is, declaration of a party in his own interest, which is never admissible," and the other which he denominates "self-disserving evidence," being declarations made by a party against his own interests, which are generally admissible against him.

To weigh and determine this question properly, you ought to consider whether anything in the interest of humanity and of the well being of your patients would be concealed by them if they knew that you would be permitted to testify to it afterward. If so, then, the rule ought not to be amended, and you would be the last persons in the world to ask that it should be. On the other hand, if the probabilities are that in ninety-nine cases out of a hundred, nothing would be concealed or untruthfully stated because

the patient knew that his statements could be used against him, and that you would be able to treat your case just as well and as fully and carefully and successfully, then the prohibition of the statutes, as interpreted by the courts, should be modified.

It is doubtless true that the dictates of what was believed to be sound public policy led to the establishment of these statutes, but their conditions have often worked a perversion of justice in the courts, and go into court to recover the amount due him for services; still in all statutory enactments in a free country, the test of the law must be whether it works the greatest good to the greatest number.

Apply that test to the statutes under consideration in this paper for yourselves, and no doubt you will reach such a conclusion as will be eminently satisfactory to the dictates of professional etiquette, and to the duty that you owe to yourselves, your employers and to public sentiment.

VERDICTS OBTAINED THROUGH PERJURY.

BY C. B. KIBLER, M.D.

In presenting briefly a line of thought that might perchance be the means of bringing out a theme for discussion from the Fellows present, I present a subject that has not, to my knowledge, been even briefly presented before any body of railway surgeons, or before any medico-legal society up to this time. If such has been the case, I am free to say it has entirely escaped my observation.

It is barely possible that the theme lacks in interest, and perhaps is untenable. Yet it has occurred to me upon many occasions, when a claimant has procured a fat verdict from some innocent corporation, with the merits of the case built entirely upon air, together with the malingering symptoms set up by the claimant, prompted by the ever ready advice of his unscruplous legal adviser, who perchance has taken the case on commission, or on the coöperative system, that when the claimant has obtained his verdict and divided up the proceeds as best appeases the scruples of his attorney, which amount, by the way, is not always the lesser of the two halves, the astonishing rapidity with which the prosecutor regains his former good health prompts one to say that the verdict was rendered, not upon the true merits of the case, but that it depended and resulted from the unscrupulous

testimony of plaintiff's apparent great suffering of pain, but strictly ephemeral in character, and from non-use, often showing atrophy of muscles.

With sympathetic friends as witnesses, who are quite prone to an elastic conception of the truth, at the same time quite forgetful of any important fact that might be at all advantageous to the defendant, and that ever-ready expert, who for a large consideration and statistics, might presumably be induced to so shape his views as to fortify the case against the corporation—with such an army, it is almost impossible for the sympathizing jury of twelve true and honest men to see any other way than to present a verdict which is supposed to be arrived at without bias, in such sum as will satisfy the claimant and make him comfortable for the balance of his natural life.

Corporations receive no respect or mercy at the hands of the ordinary jury of to-day. It matters but little how much merit or demerit any case for damages at the present time may possess. The usual result is quite probable to mulct the company for large damages.

Let it be clearly understood that no reference is here made to that class of cases in which corporations are honestly liable. This latter class almost invariably can be adjudicated through the proper claim department of any company, and generally with much better compensating results to the claimant than through the courts. It is to the malingering class I now wish to draw your attention.

It is true that it is often difficult to work out the wheat from the chaff in this line of cases, but when

you see a claimant who has been so entirely incapacitated from the performance of any and all kinds of work appertaining to his vocation before the case comes before the courts, and his ailment and symptoms greatly magnified and increased while the case is on trial, who, when the jury rendered a large verdict in his favor, and almost simultaneously with the receipt of the check for the payment of his supposed wrongs, proceeds to the almost magic recovery of his former good health — of this class of fraudulent claims I desire to speak, and can see no reason why, in a court of equity, such cases of fraud can not be made to convert to the rightful owner the proceeds of the verdict so fraudulently obtained.

I am not aware of any effort ever having been made by any corporation to recover in a court of justice in such cases, and I think, should it be proven that the attorney in the case accepted the pushing of all such cases before the courts, upon a commission to be paid him from the proceeds of the verdict, and it can be shown afterward that the case is fraudulent, that he would be equally co-respondent with the prosecutor, and likewise amenable to the same treatment as the claimant.

In the recovery of money so obtained he should, in fact, be made a co-defendant in such cases in courts of equity. If possible to recover in a few well-conducted cases, is it not possible that it will point out the way whereby those who now present such cases in court would hesitate before pushing such alleged injuries into litigation, and thus be the means of eliminating from damage accounts vast sums of money now unlawfully and wrongfully obtained?

The question might be propounded: How are we to prove the fact that the recipient of such favors by the courts of litigation are malingers? "Out of the fullness of the heart the mouth speaketh." Only by his actions, and this is quite easy of accomplishment. Let us suppose the claimant in his declaration alleges total disability of one of the extremities. By proper coaching in auto-suggestion he will carry out the by-play entrusted to him by his informant, but will he do so after he has obtained the balm of a good sized verdict that can alone soothe the pangs of imaginary pain? Think for a moment that he can not, by any process of law, be compelled to return any part of the proceeds of his ill-gotten gains. No! And thus in a very short time he will so forget himself that his own actions will be sufficient to furnish such proof as would be needed to convict himself.

There is but little use in reviewing individual cases before the Fellows of the Academy. We have only too many such examples of perfidy upon the records of almost every court in the land.

This question of perjury is one that does not carry its import and penalty deep into the minds of the majority of litigants who are unscrupulous enough to accept a large reward from corporations for the settlement of malingering claims. If a few well marked examples of such cases of perfidy could be carried to a successful issue and to a conviction, it would be well worth the time and means expended upon the subject, for the penalty in almost every State is so great as to debar the perjured person, upon conviction, from many of the rights of citizenship.

In Pennsylvania it becomes a misdemeanor and,

upon conviction, a fine of $500, imprisonment by separate and solitary confinement at labor for a term of years, and it forever disqualifies him from being a witness in any matter of controversy.

While doubtless this subject belongs to the legal department of railways, it is yet true that the aid of the surgeon must be called into the study of the surgical consideration of the same, hence making it a medico-legal one, and as such can be rightly considered and discussed by the Academy.

We are trespassing upon virgin grounds and, perchance, are ill fitted to consider and bring out a sufficient number of points, convincing in character, to maintain the position taken. With some degree of truth it can be said that such action would be beneath the dignity of a large corporation. We hold that when right and truth are on the side of the latter, nothing can be adduced by the malingerer to balance the scales in his favor. For right and truth should and must prevail.

With this brief recitation of this somewhat intricate subject, I desire not to prolong it, but gladly submit the question to the Fellows of the Academy who are more learned in legal lore than I.

DISCUSSION.

MR. BECKER- Although not a member of the Academy, I will simply make a suggestion: That the claim for injuries may be handled to more advantage in those States where statutes have been passed permitting an examination by physicians of the plaintiff before trial. It was long doubted whether the sanctity of the person was such that it would be unconstitutional to adopt such statute. That matter has been put at rest by the U. S. supreme court, and by the court of appeals of New York, which have held that there was no constitutional prohibition, at least in the State of New York, which forbids

the adoption of such statutes. There is now in force a statute in the State of New York in which it is the right of any defendant in a case founded upon personal injuries, to have an examination of the plaintiff before trial by competent physicians. I lately had occasion in practice to put that in effect in a case very closely allied to this referred to by our learned friend in his paper, and discovered with very little difficulty that no such extensive injuries existed as was claimed. It seems to me that the remedy is easily to be found there. In very few cases of a proper examination before trial would fraud escape detection, and the extent of the examination is largely in the discretion of the court. I know of no other State that has adopted that statute except New York; there is such statute in New York that permits the examination of the party, describes how it should be taken, in the presence of a referee, by a physician duly qualified. There is, however, a ludicrous feature about it. Some generous-hearted individual in the legislature secured an amendment to the statute, providing that in a case where a lady is the plaintiff, she is to be examined by a physician of her own sex. It is a ridiculous thing in the statute. A good many speak of it as a kind of joke; it was so regarded at the time it passed, but it slipped through without objection.

DR. HATCH—I represent the Burlington & Quincy. There is a case now pending, a threatened lawsuit. These parties were injured about six weeks ago and they demand damages from the railroad company, and they employed an attorney. I represented the company, told them that if the company was liable and they were iniured it was not our desire to have any litigation and I demanded an examination of the parties which they absolutely refused. I contend that as a representative of the company I have a right to do this.

MR. BECKER—The supreme court of the United States held that the right does not exist independent of the statute. There is no right unless there is some statutory action that permits it.

DR. GARDNER -I can relate a case similar to the one my friend here relates. It is the case of an injury on the Southern Pacific last October. As chief surgeon of the company I was sent down by our chief attorney to investigate the case and asked for an examination of the case by our physician at Los

Angeles. It was refused. The request was made by Dr. Ainsworth through me and I was to be present. The case finally came to trial and in that case the request, such as my friend Dr. Hatch spoke of, was placed in court as a request of the company to show that we wanted to treat them fairly and to make the examination by not only myself, but a physician in the employ of our company. As a result the case was non-suited and finally was disbarred entirely. The moment you place the fact before a jury that a man refuses to be examined by a competent physician, who is recognized as reputable in the neighborhood and in the city in which he lives, it bears a certain weight with the jury and invariably the verdict is the other way.

DR. MAYNARD--My judicial friend on the right here has presented this case well, but I object to papers of that character being read and printed by this Academy. I have had twenty-odd years' experience with railway companies, and I know there is no gentleman in this room who does not know that the general managers or the claim departments of the different roads are inclined to use us simply as adjuncts to the claim department, and I do not propose in my railway service to be held in any such light. The more papers we have in that line, and the more discussion we have printed, the more we will be likely to be regarded as adjuncts to the claim department of the different roads. Our motto is: "The higher the order of railway surgery the greater the protection to the employé, the passenger and the company," and I think we ought to confine ourselves exclusively to that, and not make ourselves, any further than we can help, fifth wheels of the claim department.

DR. GARDNER- I take exceptions to those remarks. In my instructions in my department, I will not allow a surgeon in my service to appear as an expert under any circumstances but purely to testify as to facts. It is a procedure I have adopted in my service and I insist upon it. I shall never compromise, and a man in my employ who goes up as an expert loses his job.

DR. DALBY I do not see very much relevancy between the remarks of Dr. Gardner and our friend from Cheyenne, so I expect we are all in line. I think Dr. Kibler's paper is a good paper. The question as to the merit or demerit of its publication in our proceedings is one for the Association itself to

determine. I think that our relationship with the various attorneys and railway organizations is a very close one. No railway organization can go into court with a suit without depending and relying more or less upon the officers of that company. I do not believe that they look upon us as the fifth wheel or the seventeenth wheel of the claim department, but they certainly do look upon us as being able to give them some information which we do have and which I think it is proper for us to give. Speaking on the question of getting damages on perjured testimony, it is something that those connected with a railway have often seen. It is brought about by various conditions. In Salt Lake City, invariably every man, woman and child bring suit against a railroad company, it makes no difference whether they have any visible mark or not, the suit is brought and the jury will invariably find for them in various amounts. I recall now, among several instances, a case involving an examination of the injuries. Six or seven months ago we had a suit brought against the Union Pacific Railway on the part of a mother and daughter. The mother was a lady of middle age, and the daughter somewhere in the vicinity of 20. The mother claimed damages for injury to the spine, the daughter brought suit for a fracture of the nose. Neither of these cases had been treated at any time by any surgeon who had any connection with the company proper at all. They were each suing for $5,000 damages. The solicitors of our road asked permission of the court to grant me the privilege of examining them, as the company itself had no evidence or no idea as to the extent of these alleged damages. The court finally permitted me to examine the daughter for a fractured nose, in company with her attending physician, but denied me the privilege of examining the mother. Where the distinction came in I do not know. But in carrying out the ideas of the paper that the doctor just read, obtaining verdicts on perjured testimony, there was a girl who had been enticed to go into court for a claim of $5,000 for a fractured nose. Her attendant physician claims he examined her nose and found some irregularity in the nasal passage; in other words, the nasal passages were not alike. He described very graphically during the trial of the case the condition of the girl. As a matter of fact, and as he agreed with me in the examination I

made with him, there was a turbinated bone, which merely loosened up the one muscle. That was where he found his fracture, and that was all that existed. At any rate the jury returned a verdict for her mother for $5,000 and the daughter for $2,500, and I got the reputation of being a railway hireling for my own testimony.

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